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GUIDE TO COMMERCIAL SHARK FISHING IN THE CARIBBEAN AREA

Fishery Leaflet 135

Fish and Wildlife Service

Washington, D. C., 1945

GUIDE TO COMMERCIAL SHARK FISHING IN THE CARIBBEAN AREA

ANGLO-AMERICAN CARIBBEAN COMMISSION

Fishery Leaflet 135

Washington, D. C., 1945

UNITED STATES DEPARTMENT OF THE INTERIOR
Harold L. Ickes, Secretary

FISH AND WILDLIFE SERVICE
Ira N. Gabrielson, Director

Foreword

SHARK FISHING is becoming increasingly more important throughout the Western Hemisphere because of the valuable yield of vitamin oils, high quality leather, and food products obtained from sharks. The war program of the United Nations has greatly accentuated the critical need for shark products. GUIDE TO COMMERCIAL SHARK FISHING IN THE CARIBBEAN AREA was prepared and published by the Anglo-American Caribbean Commission in March 1945. Its purpose is to make available throughout the Caribbean Area up-to-date information and suggestions on the catching and identification of sharks, and to outline practical methods for the preservation, processing, and marketing of shark products. The Fish and Wildlife Service believes that the booklet will be useful to present and potential shark fishermen everywhere. The Anglo-American Caribbean Commission generously has granted its permission for republication and distribution of the booklet by the Fish and Wildlife Service, which is here presented to the public as FISHERY LEAFLET 135.

In presenting the booklet to the public, the Fish and Wildlife Service emphasizes that the information on trade channels and prices presented therein are subject to constant change and their continued accuracy cannot be guaranteed.

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INTRODUCTION

Attention has been drawn frequently to the fact that the Caribbean area is largely dependent on imports for one of its chief sources of first class protein, fish. The Anglo-American Caribbean Commission, therefore, has from the very start taken a deep interest in encouraging the development of local fisheries. Among the plans formulated, the commercial possibilities of shark fishing occupy an important place. The first West Indian Conference at Barbados in March, 1944, emphasized that the possibilities of shark fishing in the Caribbean area had not been fully explored, and recommended that accurate information on this subject should be collected and distributed. This pamphlet attempts to set out, for the benefit of the people and fishermen of the Caribbean, the best available information on sharks—their varieties, location, by-products, commercial and nutritional value, and the methods of catching, processing and marketing. them.

After having looked over the Caribbean carefully, we believe that there are many places in this area where people can make money fishing for sharks. Practically every part of a shark has a value. For instance, the hide produces good leather; the liver produces oil often rich in Vitamin A, while the fins of all except the nurse shark bring a high price for soup making; the white meat, either fresh or salted, of most kinds of sharks, is a wholesome human food and the rest of the meat can be converted into animal feed and fertilizer. Good prices can be obtained for all these products, and it is therefore surprising that, with the exception of Cuba, commercial shark fishing hardly exists in the Caribbean.

There are two main reasons why shark fishing has not progressed in the Caribbean. In the first place, unless shark products are handled on the correct lines, the profit is very disappointing. In the second place, most of the fishermen who can enter into this trade cannot wait for their money; and because of poor products, with correspondingly low returns, coupled with lack of available information as to how to do better, local capital has not

been available to finance fishermen. This pamphlet aims at removing these difficulties.

To make money out of shark fishing the first thing is to "know how". Different sharks have different values for their various products and even the same kind of shark will vary according to whether it is male or female and according to the time of the year. It is therefore important for you to know what sort of shark you are dealing with and what kinds of sharks are likely to be in your locality, and when and where they can be caught. You can obtain part of this information from Section 1. In Section 2 are outlined some methods for catching sharks which we think will work in the Caribbean. These ideas are not based on theory but on practical, successful experience in the Caribbean area. In the following sections you are told how to handle the various shark products. This is all the "know how" of commercial shark fishing.

But "know how" is not enough. If you are to make a success of shark fishing you must follow the instructions carefully. Remember that shark products spoil more easily than most animal products and you are working in a hot, humid climate where this spoilage is very rapid. Shark livers begin to deteriorate almost as soon as the shark is dead; hides may lose half their value if skinning is delayed for more than six hours; flesh begins to spoil in a few hours. Never leave sharks or shark products (except fins) in the hot sun. Start preparing the products as soon as the shark is killed and go straight through with the preparation as described in these notes. Keep everything clean and washed down. Where salt is used, use only a good grade salt, free from pink tint and use plenty of it. If you follow these instructions you will produce valuable products. If you do not, you will produce worthless products which will not even pay your freight charges.

Often those who catch the sharks are too tired to start preparing the products immediately. It would therefore be well to consider the possibility of having a separate working gang, fresh and ready to begin operations as soon as the sharks are brought in port.

The final aim should be to use every part of the shark. At the beginning, however, prepare only two products. When you have two processes going smoothly, then you may include others.

In most places sharks are rather seasonal, being common at some times and not at others. Different sharks have different seasons. For this reason you may find that you can fish sharks profitably at only one time of the year and have to combine this with other types of fishing.

At the present time you will find freight rates high and shipping difficult. On the other hand war conditions have so increased the value of many shark products that their present value more than outbalances the increased cost and difficulty of shipping. Some of these products, particularly Vitamin A, are urgently needed war materials. By actively carrying on shark fishing along the proper lines you will not only be making money for yourself, but you will be assisting in the war effort.

This report does not pretend to be a scientific work nor is it intended to be a theoretical discussion. It aims at but one purpose, namely, to tell you how you can best make shark fishing profitable to yourself.

The Anglo-American Caribbean Commission

March 1945

SECTION I

HOW TO IDENTIFY SHARKS—THEIR HABITS AND WHERE THEY ARE LIKELY TO BE FOUND.[1]

There are more than 40 different species of sharks to be found in the waters of the Caribbean. Some of these are worth more than others, and it is most important that you know which types are commercially valuable and which are not. If your catch includes too many sharks with little or no value, you will not be able to make much money shark fishing. On the other hand, if you can recognize the different species and if you know how to avoid catching the poorer types and where to find the valuable ones, you should be able to make a very good profit.

For example, the Bonnethead Shark, the Sawfish Shark, the Tiger Shark and the Nurse Shark are very low in the Vitamin A content of their livers. Vitamin A is the most important commercial product of shark livers. The rest of the sharks, particularly the Requiem Sharks and the Hammerhead Shark, have a high Vitamin A content. This difference in sharks applies to other products as well. The Nurse Shark, for example, has the best hide. The hides of all the other species sell at good prices but nevertheless at slightly lower prices. On the other hand, the fins of the Nurse Shark are valueless, while those of most of the other species sell at good prices. Certain sharks are not good for human consumption, such as the Hammerhead, which should never be used for this purpose.

In general, each species can be found in definite localities, and a little experimental fishing should enable you to decide where the best sharks can be caught in your region. For instance, the Bonnethead Shark and the Tiger Shark are generally found in very shallow water

[1] The material in this Section, as well as in the Appendices, has very kindly been provided by Dr. Henry B. Bigelow and Mr. William C. Schroeder of The Museum of Comparative Zoology at Harvard University.

(less than 5 fathoms). The Sawfish[2] has a great tendency to congregate near the mouths of rivers where it feeds upon refuse flowing down from the interior. The Tiger Sharks will be most frequently found near the entrance to harbors or near canning factories and slaughter houses from which waste is dumped.

It is best, therefore, to fish in deep waters (15 fathoms or more) and in waters which are free from refuse and far from mouths of rivers. Since the greatest number of species and specimens in the Caribbean are to be found near the outer slopes of the islands and reefs, it might be well to concentrate fishing at these offshore banks where there is little likelihood of finding waste materials to feed on, but where there would be many types of food fish upon which sharks could prey.

HOW TO IDENTIFY SHARKS

Among all the important sharks to be found in the Caribbean, there is wide range in appearance, size, activities, feeding habits and migratory movements.

There are pigmy species that do not grow more than a couple of feet long, and there are such giants as the Man Eater, the Basking Shark and the Whale Shark. The Whale Shark reaches a length of 60 feet and is by far the largest of fishes. Some, such as the Mako and the Black-Tipped are strong swift swimmers; others are sluggish.

A few sharks, including two of the largest, the Basking and the Whale Shark, feed partly or wholly on minute organisms. A few others, such as the smooth dog fishes, feed chiefly on crustacea (crabs, lobsters, etc.). The great majority, however, are fish eaters, some preying chiefly on small fish and others on large fish, as well as on sea turtles and seals. Several species have the troublesome habit of biting great pieces from other sharks that have been hooked or entangled in nets. The Tiger Sharks and the large Hammerheads are particu-

[2] The Sawfish is not further described in this Section or in the Appendices since it is easily recognized by the bony saw at the end of the snout. It is a rather infrequent visitor to Caribbean island waters and its liver and liver oils are completely valueless.

lar offenders in this regard. Sharks which are sluggish in their movements are less aroused by the scent of food than the swifter swimmers, and to these species the scent of blood is most stimulating.

A few, such as the smooth dog fishes, migrate regularly northward and southward along the coast of North America, while others are swept northward each year during the warm seasons for long distances by the Gulf Stream. In general, however, most of the kinds remain in the same localities the year around except as they range to and fro in search of food.

Some of these sharks will be easy for you to identify, but others will be more difficult because they look so much alike. Fortunately it is fairly easy to recognize the sharks which you should avoid catching. All of the species, however, can be distinguished by some feature or group of features which set each one apart from the others. The two keys which follow are based upon these differences and will enable you to identify 35 different species found in the Caribbean area.

In general the two keys are set up as follows: Of the 35 sharks described here, 30 have an anal fin and 5 do not. Those with an anal fin are divided into 3 groups, depending on the number of gill openings they have. One species has 7 gill openings, another 6 openings, and the remaining 28 have 5 gill openings. All of the sharks with no anal fin have only 5 gill openings. In both anal and non-anal groups, sharks are further subdivided into 2 groups, those with ordinary shaped heads (that is, not expanded sidewise at the eyes) and those with hammer or shovel-shaped heads. All of the sharks in Key I, for example, have an anal fin, 5 gill openings and an ordinary shaped head.) Sharks in each one of the above groups are further separated from one another by some distinctive feature or groups of features, such as a ridge along the middle of the back, the mouth at the tip of the snout, a barbel at the nostril, all five gill openings in front of the pectoral fins and so forth.

To use these keys for identification, first turn to Figure 19 in Appendix A which shows a simple outline of a shark with all the important features clearly marked

and located. Figure 21 will show you how to distinguish between the male and female shark. You should then compare your shark with Key I. This key is devoted entirely to the identification of the 8 most numerous species of the smaller sharks to be found in the Caribbean area. These are Requiem sharks, members of the genus Eulamia. Since probably more than 50% of all the sharks more than 4 to 5 feet long that are caught in the Caribbean are Eulamias of one kind or another, it is very possible that your shark can be identified as one of this group.

If your shark has the features listed in this key which are to be found in all Eulamias, you should decide what further distinctive features it has. If, for example, your shark has a distinct ridge along its back between the first and second dorsal fins ("A" in the key) and the free rear tip of its second dorsal fin is more than twice the height of the fin ("I" in the key), it will be either the Silky Shark or Eulamia falciformis. These two sharks are distinguished from each other by certain differences in appearance, which are also noted in the key. Or if, for example, your shark has this distinct ridge along its back as above but the free rear tip of its second dorsal is much less than twice as long as the height of the fin ("2" in the key), it will be either the White-Tipped Shark, the Dusty Shark or the Brown Shark. These also are distinguished from each other in the key.

If, on the other hand, the shark does not have all of the features which are common to Eulamias, you should turn immediately to Key II and follow a similar procedure. This key gives the chief distinguishing features of the remaining important species which are to be found in the Caribbean region. Here, all sharks with an anal fin are classified under I; all without this fin, under II. Those with an anal fin, 5 gill openings and an ordinary shaped head are listed under I C 1, while all with an anal fin, 5 gill openings and a hammer head are under I C 2, and so forth throughout the key.

When you have identified the shark, turn to the corresponding Figure, the number of which has been given in the keys. The Figure shows an outline drawing of the

shark identified. Following each Figure is a detailed description of its appearance, breeding and feeding habits, migratory movements, locality and depth frequented, size and other characteristics, all of which will help you to locate the shark again if you wish.

Key I to the Common Eulamias—Figures 22 through 29

Many of the Eulamias resemble one another so closely that few fishermen distinguish between them except perhaps for one or two species that may be caught the most often in any particular locality. Most of them lack common names. At present only about eight of the fifteen species which are known to occur within the Caribbean area are numerous enough or large enough to be of interest to fishermen.

All **Eulamias** have the following features:

An anal fin
Five gill openings
An ordinary shaped head
No spiracles
No furrow on the lower jaw and only a very short one on the upper
No ridges lengthwise on the caudal peduncle
Mid-point of the base of the first dorsal fin is nearer to the center of the pectoral fins than to the origin of pelvic fins
The cusps of the upper teeth are regularly serrate (or saw-edged)
The cusps of the lower teeth are serrate or smooth

Eulamias are distinguished from one another as follows:

A. Eulamias which have a distinct ridge along the middle of the back between the first and second dorsal fins and which also have (1) or (2): Figures 22, 23, 24, 25, and 26.

1. Free rear tip of the second dorsal fin more than twice as long as the height of the fin—Figures 22 and 23.

Silky Shark, floridanus, Figure 22.
The pectoral fins of this species are nearly or are as long as the head (that is, the distance from the snout to the fifth gill opening).

falciformis, Figure 23.
Its pectoral fins are shorter than those of the Silky Shark (only 2/3 as long as the head). Its snout is also much more broadly rounded.

2. Free rear tip of the second dorsal fin much less than twice as long as the height of the fin—Figures 24, 25, and 26.

White-Tipped Shark, longimanus, Figure 24.
Tip of first dorsal fin is very broadly rounded and tip of anal fin reaches nearly to the origin of the lower caudal lobe.

Dusky Shark, obscurus, Figure 25.
Tip of first dorsal fin is angular or only narrowly rounded and tip of anal is not near the origin of the caudal lobe.
Origin of first dorsal fin is about over the inner corner of the pectoral fin when the latter is laid back; its vertical height is less than the distance from the eye to the first gill opening.

Brown Shark, milberti, Figure 26.
First dorsal and anal fins are like the Dusky Shark.
Origin of first dorsal, however, is over the axil (armpit) of the pectoral; its vertical height is at least as great as the distance from the eye to the third gill opening.

B. Eulamias which are smooth along the middle of the back between the first and second dorsal fins, without a trace of a ridge along its length, and which also have (1) or (2): Figures 24, 27, 28, and 29.

1. A very broadly rounded first dorsal fin and the tip of the anal fin reaching nearly to the origin of the caudal—Figure 24.

White-Tipped Shark, longimanus (adult), Figure 24.

2. Narrowly round first dorsal fin and the tip of anal fin is not near the origin of the caudal-Figure 27, 28 and 29.

Bull Shark, leucas, Figure 27.
Snout is extremely short and very broadly rounded.
Fins not tipped with black.

Small Black-Tipped Shark, limbatus, Figure 28.
Snout is longer than in the Bull Shark (the snout, in front of a line connecting the outer end of the nostrils, is at least 2/3 as long as distance between nostrils.)
Fins conspicuously tipped with black.
First gill opening less than 2½ times horizontal diameter of eye.

Great Black-Tipped Shark, maculipinnis, Figure 29.
Snout and fins are similar to those of Small Black-Tipped Shark.
Origin of first dorsal fin is over or behind the inner corner of the pectoral fin when the latter is laid back.
First gill opening is more than 4 times as long as horizontal diameter of the eye.
Margins of lower teeth perfectly smooth.
Some of the fins conspicuously tipped with black.

Key II—To All Important Species of Sharks, With the Exception of Eulamias, Which Are To Be Found in the Caribbean Area.

1. Sharks with an anal fin—Figures 30 through 51.

A. Seven gill openings and 1 dorsal fin.

Seven-Gilled Shark, Heptranchias perlo, Figure 30.

B. Six gill openings and 1 dorsal fin.

Six-Gilled Shark, Hexanchus griseus, Figure 31.

C. Five gill openings and 2 dorsal fins, Figures 32 through 51.

1. Ordinary head shape (that is, not widely expanded sidewise at eyes). Figures 32 through 47.

a. Mouth at tip of snout.

Whale Shark, Rhincodon typus, Figure 32.
Also conspicuous white or pale yellow spots and several ridges lengthwise along sides.

b. Conspicuous barbel reaching from edge of each nostril to mouth.

Nurse Shark, Ginglymostoma cirratum, Figure 33.

c. All five gill openings located in front of the pectoral fins, at least at their lower ends.

Sand Shark, Carcharias taurus, Figure 34.
Lower lobe of its caudal fin only about 1/3 long as upper.
Second dorsal fin and anal fin about as large as first dorsal.

Mako, Isurus oxyrhincus, Figure 35.
Lower lobe of its caudal considerably more than 1/2 as long as upper.
Second dorsal and anal fins much smaller than first dorsal.
Teeth slender with smooth edges.

Man-Eater, Carcharodon carcharias, Figure 36.
Caudal, dorsal and anal fins same as in Mako. Upper teeth, however, broadly triangular with serrate edges.
Lower teeth narrowly triangular with serrate edges.

d. Caudal fin about 1/2 as long as total length of shark.

Common Thresher, Alopias vulpinus, Figure 37.

e. Lower caudal lobe—Sharp-pointed and directed rearward.

Florida Dog Fish, Mustelus norrisi, Figure 38.
Mid-point of base of its first dorsal fin much nearer to origin of pelvic fins than to the axil (armpit) of the pectorals.
Teeth low rounded without definite cusps.
Eyes without "winking" membrane.

f. Lower caudal lobe—Broadly rounded.

Common Smooth Dog Fish, Mustelus canis, Figure 39.
Mid-point of base of first dorsal about same distance between pelvic fins and axil of pectoral.
Its teeth low without definite cusps.
Eyes without "winking" membrane inside lower eyelids.

g. Dorsal fin—At least 1/2 of the base of first dorsal fin is over pelvic fins.

Cat Shark, Scyliorhinus torrei, Figure 40.

h. Dorsal fin—Second dorsal fin almost as large as first dorsal and anal fins.

Lemon Shark, Negaprion brevirostris, Figure 41.
The middle of the base of the first dorsal fin is as near to axil (armpit) of pectoral fins as to the origin of pelvics or nearer.

i. Teeth—Blade or awl-like (see Figure 42). Only one or two in series function simultaneously; eyes have "winking" membrane inside lower eyelids (see Figure 20).

Tiger Shark, Galeocerdo cuvier, Figure 42.
Lower and upper teeth shaped as in Figure 42. Labial furrow on upper jaw is about as long as the snout in front of mouth.
There is a spiracle.

Great Blue Shark, Prionace glauca, Figure 43.
Lower teeth very obviously not shaped like those of the Tiger Shark shown in Figure 42. Labial furrow on upper jaw, if present, much shorter than snout in front of mouth.
No spiracles.
Mid-point of base of first dorsal is much nearer to the origin of pelvics than to axil (armpit) of pectorals.

j. Teeth—With 3 or 4 sharp cusps (or points) in several functioning series.

Pigmy Dog Fish, Triakis barbouri, Figure 44.

k. Teeth—Edges of primary cusps of upper teeth perfectly smooth.

Smooth-Toothed Shark, Aprionodon isodon, Figure 45.
Second dorsal and anal fins obviously much smaller than first dorsal.
First gill opening more than 3/4 as long as distance between inner edges of nostrils and the snout in front of mouth.
Upper and lower teeth erect, symmetrical, slender, their edges not notched.

Sharp-Nosed Shark, Scoliodon terraenovae, Figure 46.
First gill opening less than 1/2 as long as distance between inner edges of nostrils and not more than 1/4 as long as snout in front of mouth.
Upper and lower teeth more or less oblique, their outer edges deeply notched.

Well-marked labial furrow on lower and upper jaw.
Mid-line of back between dorsal fins smooth without ridge.

Night Shark, Hypoprion signatus, Figure 47.
Length of first gill opening and teeth same as in Sharp-Nosed Shark.
No labial furrow on lower jaw.
Lower teeth differ from uppers, obviously more slender and more erect than uppers and symmetrical.
Low but unmistakable ridge along middle of back between two dorsal fins.

2. Hammer or shovel-shaped head. Figures 48, 49, 50 and 51.

   a. Front of head not indented or scalloped in mid-line.

   Bonnet Shark, Sphyrna tiburo, Figure 48.
   Outline of head only slightly concave opposite nostrils (if at all so).
   Free rear tip of second dorsal not longer than the front margin of the fin.
   Rear margin of anal fin weakly concave.

   Common Hammerhead, Sphyrna zygaena, Figure 49.
   Outline of head deeply scalloped opposite nostrils.
   Free rear tip of second dorsal considerably longer than the front margin of the fin and the rear margin of anal fin deeply concave.

   b. Front of head unmistakably indented or scalloped in the mid-line.

   Hammerhead, Sphyrna diplana, Figure 50.
   Free rear tip of second dorsal considerably longer than its vertical height and at least as long as its front margin.
   Pelvics with nearly straight front margins.

Cusps of both upper and lower teeth smooth edged, serrations (if any) being confined to their basal expansion.

Great Hammerhead, Sphyrna tudes, Figure 51.
Free rear tip of second dorsal only about as long as its vertical height and considerably shorter than its front margin.
Pelvics with strongly convex front margins.
Margins of teeth serrate on cusps as well as on basal expansions.

II. Sharks with no anal fin—Figures 52 through 56.

A. Ordinary shaped head—Figures 52 through 55.

1. Strong conspicuous spine along front margin of each dorsal fin; snout projects considerably beyond mouth; eyes on sides of head; front margins of pectorals do not overlap gill openings.

Common Spiny Dog Fish, Squalus acanthias, Figure 52.
Spine of first dorsal fin is over the inner corner of the pectoral or to the rear of it.
Inner corner of pectoral is rounded, its far margin only weakly concave.
Upper and lower teeth alike, each with one cusp only (See Figure 52).
Lower rear margin of caudal fin not notched near the tip

Cuban Spiny Dog Fish, Squalus cubensis, Figure 53.
Spine of first dorsal fin is about over the midpoint of the inner margin of the pectoral.
Inner corner of pectoral fin pointed, its far margin deeply concave.
Teeth and lower rear margin of caudal fin are like those in Common Spiny Dog Fish.

Black-Bellied Dog Fish, Etmopterus hillianus, Figure 54.
Upper teeth noticeably unlike, lower with only one cusp but upper with several.
Lower rear margin of caudal is notched near tip.

2. No spines on dorsal fins.

Luminous Shark, Isistius brasiliensis, Figure 55.

B. Head expanded sidewise, Figure 56.

Angel Shark, Rhina dumeril, Figure 56.
Very flat body, top and bottom.
Eyes on back of head.
Front margins of pectorals overlap the gill openings.

SECTION II

HOW TO CATCH SHARKS [8]

There are three methods by which sharks may be caught in the Caribbean—the simple hand line, the chain set line and the net. All of these methods will be described in this section. The one which you should use will depend upon the size of your operation, the size of your boat, the types of sharks which are generally caught in your locality and the condition of the ocean bottom.

The depths for which you should design your equipment depend largely upon the depths usually frequented by the sharks in your locality. Types of sharks, their habits and where they are to be found are discussed in Section 1 and in Appendix C. Some sharks, for example, are customarily found in shallow water and others come into shallow water only at night to feed. In general, however, sharks are a bottom feeding fish and those which are caught in deep water tend to be more valuable because the Vitamin A content of their liver oil is higher.

The bait which you should use will also depend somewhat upon the type of sharks in your locality. Feeding habits among different species of sharks vary greatly. This is also discussed in Section 1 and Appendix C. In general, however, an oily fish is a good bait, preferably if it is a bit "high". Porpoise meat is said to be very effective. Mullet and bonefish are also good. Sharks hunt their food by sense of smell and some sharks are particularly attracted by blood. Chumming with blood, therefore, often brings sharks to the hook. The dark portions of bonita or small tuna are full of blood and are good bait.

Methods of Catching Sharks

The simple hand line should be used when one or two men are going out in a small dinghy. The net is profitable for large-scale fishing only. The chain set line is

[8] The Distillation Products, Inc., of Rochester, New York, has very kindly contributed the material in this Section and in Section 3.

probably the most successful method and may be used if a large enough boat is available and if there are at least three or four men.

The simple hand line. Generally two men go out and each one operates a single line. This line should be at least 72-thread, medium laid and long enough for the depth of the water fished. Six to eight feet of 1/16-inch to 1/8-inch stranded wire cable or a 3/16-inch chain is used as a leader which is connected to the line by a swivel. Shark hooks[4] can be obtained in sizes from 2 to 4 inches across the jaw with either needle or ringed eyes. When used with a hand line, they are generally spliced directly to the wire leader.

The chain set line is a system of multiple hook set lines which can be set up in several ways. Figure 1, for example, illustrates the most effective chain set line to use where the ocean bottom is relatively even. Figures 2, 3 and 4 can be used where the ocean bottom is heavily studded with coral which would hopelessly foul the anchors and hooks of the first method. These lines are illustrated on the following pages.

Figure 1. This chain set line consists of a ground line made up of sections of 3/16-inch galvanized chain, 600 feet long. At 30-foot intervals along this chain, 6 feet of 3/16-inch galvanized leader chain, together with swivel and hook, are attached with heavy harness snaps (sometimes called snap hooks) to the main line. The line is anchored at both ends and marked with flag buoys at the surface. One boat can tend two or three lines 1,200 to 1,800 feet long per day.

Shark hooks and chains are probably available at your local fishery supply houses. They can be purchased in the United States from the following firms: Wright and McGill Company, 1461 York Street, Denver, Colorado; The Enterprise Manufacturing Company of Akron, Ohio, Dept. SOF; Ocean Leather Products, Garden Street, Newark, New Jersey; and Bill Dewitt Baits, Boxes and Fishhooks, Shoe Form Company, Inc., 1942 Orelius Avenue, Auburn, New York. The Fish Hook Export Group, 16 Unicorn Hill, Redditch, England, will supply the names of companies in the United Kingdom which carry these supplies. For information regarding Canadian supplies, inquiries should be addressed to the Trade Commissioner for the British West Indies and British Guiana, 37 Board of Trade Building, Montreal, P.Q., Canada.

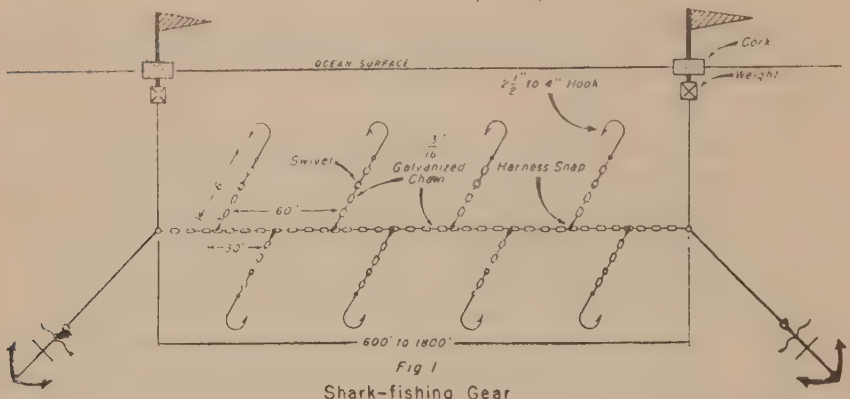


Fig 1
Shark-fishing Gear

Figure 2. This line is slightly different from Figure 1. It consists of 6 to 10 floats and a line and may be operated as a unit. The distance between the buoys should be about 2½ times the length of the hook line.

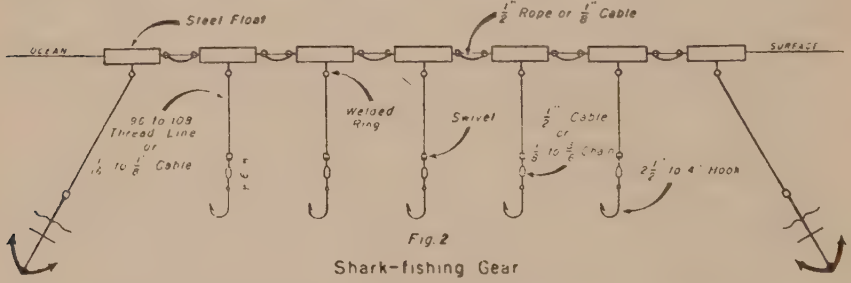


Fig. 2
Shark-fishing Gear

Figure 3. This is a variation of the preceding buoy line. It has the advantage of being able to fish deep without increasing the distance between the buoys to an impractical length. The distance between buoys should be 2½ times the length of the lower segment of the hook line.

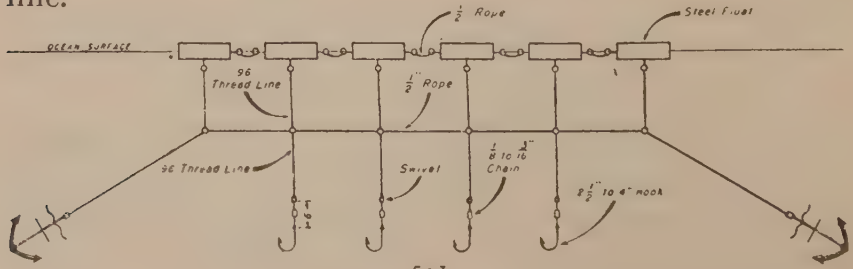


Fig 3
Shark-fishing Gear

Figure 4. The considerations for this rig are the same as for the two previous lines described.

For fishing by the chain set line, the boat which has been used successfully in the North is a 35-footer with a 10-foot beam and a 2½-foot draft. The engine is near the stern in a small cockpit. The forward part of the boat is open for carrying the catch. These boats are rigged with a stout 10-foot mast and a boom with a tackle for hoisting the sharks aboard.

When the set lines are run each day, one anchor is brought up and the chain is run over a rotating drum mounted on the gunwale near the bow. As the boat moves forward each hook should be examined to make sure that the bait is on properly. When a shark is brought to the surface he is gaffed and the large hook from the boom is inserted in his jaw. It is then possible to hoist him aboard. Since these fish are dangerous, they are usually killed before being taken off the hook.

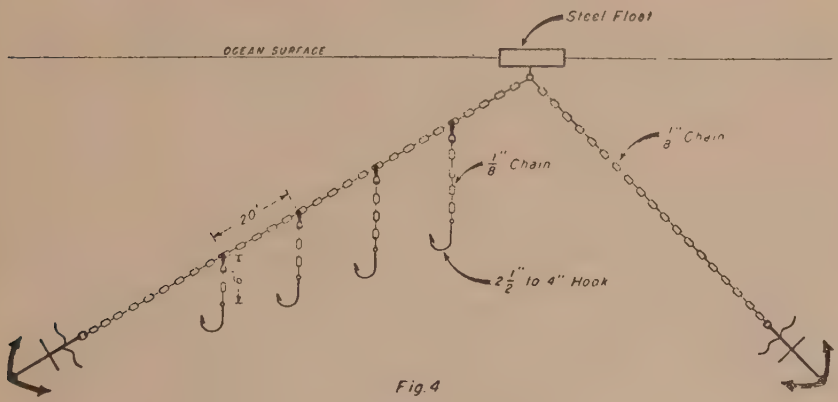


Fig. 4
Shark-fishing Gear

The net is a popular method with shark fishermen, especially on the west coast of the United States where at the present time almost all of the sharks landed are caught by this means. Nets which have been used successfully in the Caribbean, where the sharks are larger, are about 100 fathoms long and 2 to 4 fathoms deep. They are made with 72-cotton thread with a 20-inch mesh hung on a ½-inch hemp or Manila head rope. Cork buoys

at 3-foot intervals support the head, and the foot rope is weighted with 4-inch leads.

These nets, however, do not last more than three or four trips because of the damage done to them by the captured sharks. They are expensive and difficult to obtain during wartime. This method is not recommended except where large-scale fishing is intended.

SECTION III

SHARK LIVERS AND LIVER OIL—HOW TO HANDLE THEM PROFITABLY AND HOW TO ESTIMATE WHAT THEY ARE WORTH

Shark livers and liver oil are valuable chiefly for their Vitamin A content. The amount of this Vitamin which is found in livers varies in different sharks depending upon the species, sex, feeding habits and the time of year.

The Bonnethead Shark (Figure 48), the Sawfish Shark, the Tiger Shark (Figure 42) and the Nurse Shark (Figure 33) have very little Vitamin A. This lack is undoubtedly dependent to some extent upon their feeding habits. The Sawfish, for example, feed chiefly on refuse flowing down rivers from the interior. Tiger Sharks feed on waste found near the entrances to harbors or near canning factories and slaughter houses.

On the other hand, the rest of the sharks of the Caribbean area generally average a good Vitamin A content. The Requiem Sharks are higher than most and the Hammerhead probably has the most valuable liver in the Caribbean area.

The Vitamin A content is higher also in males than in females, although this difference is not great. It is mentioned here chiefly to explain certain differences in price which may occur for your shipments. There is also a variation in content at different times of the year, but these differences, too, are small and are not very well understood, therefore no formula can be given for this fact at the present time.

In general you should try to avoid fishing in places where you will be apt to catch any one of the four sharks which will lower the value of your total catch. Methods of recognizing and locating different species of sharks have been discussed in Section 1 and in Appendix C.

It is important for you, however, not only to keep the total value of your catch as high as possible, but also to protect the Vitamin A in the sharks which you have caught by taking care of it as soon as possible. Other-

wise your product will be worth very little. In this section we have outlined the methods of handling the liver and the oil from the moment the fish is caught up to the time the product is shipped to the purchaser.

Handling

Livers spoil rapidly once the sharks have been taken from the water. You should either (1) preserve the livers or (2) extract the oil from the livers as soon as possible after you have caught the sharks. Delay in taking either one of these steps causes fatty acids and other chemicals to form which will lower the value of the oil by destroying the Vitamin A and by increasing the odor and taste. If you wish to ship entire livers to the purchaser, you should treat them with a preservative. If you prefer to ship only oil, you should extract it immediately.

Preserving

Ice or refrigeration equipment on board your boat will, of course, provide an immediate though temporary means of preservation. You should remove the liver as soon as the shark has been caught and ice it down in convenient sized containers. This keeps the liver from spoiling for three or four days.

If you do not have ice, do not attempt to butcher until you get to port.

Immediately on reaching port, treat the livers with a more permanent preservative. There are three processes, (1) salt, (2) aquacide and (3) soda ash and sodium nitrate, any one of which will preserve the livers for the necessary period of time. Before any of the methods are used, however, you should remove or drain the gall which is greenish in color and which is located between the two lobes of the liver. Use salt water to wash away the blood and slime.

(1) **Salt.** To preserve by salt, cut the livers into sections three fingers wide. Roll in a good grade salt and pack in leak-proof wooden or metal containers. Make sure that there is no air space between the pieces and that the containers are filled to the top. If not, add a small amount of brine solution. By this method, livers

should be well protected for a period of one or two months.

(2) **Aquacide.** Aquacide is a commercial product specifically prepared to preserve livers. Full information regarding this product may be obtained from the Aquacide Company, 724 Eleventh Street, N.W., Washington, D. C. Information concerning similar products may be obtained from British Colloids, Ltd., Port Royal, London, N.W., 10; Glaxo Laboratories, Ltd., Green Ford; and Lever Brothers, Port Sunlight, England. However, for commercial purposes either one of the other methods described here will be satisfactory.

(3) **Soda ash and sodium nitrate.** This method can be used only when you can get the necessary equipment and material, but it is probably the most effective. First make a mixture of 90 percent soda ash and 10 percent sodium nitrate. Put this into a solution with an equal volume of water. Five percent of this solution is then added to livers which have been washed and thoroughly ground. The liver and preserving mixture are then packed in wooden or metal containers.

Extracting the Oil

You can extract the oil from small lots of livers very inexpensively by using a double boiler. Place chopped livers in the inner boiler and add a little water. Heat for about 45 minutes. The liver tissue will break down and the oil will be set free. On standing, the oil will rise to the surface where you can skim it off. The oil which is obtained, however, is not as rich in Vitamin A or as valuable as oil which is obtained by the following method.

This second method is not recommended unless the number of sharks caught is large enough to cover the costs of the expensive equipment which would be necessary. If you can use this method profitably, however, you would get more oil and Vitamin A from your catch than by the other processes of preserving the livers, and of course you would be able to ship oil much more cheaply than entire livers.

If you can and wish to build a rendering plant such as would be necessary for this process, more complete

details than we are able to set forth in this guide could be obtained by writing to the Anglo-American Caribbean Commission, 810 18th street, N.W., Washington, 25, D. C.

In general, however, this method of extracting the oil is as follows: Grind or chop the shark livers thoroughly with a sausage meat grinder or a meat chopper, mix with water and pump into a steam-jacketed kettle. This kettle should be fitted with a mechanical stirring device and a means for blowing steam, at about 15 pounds pressure, through the liver and water mixture. Add water to livers in a ratio of two parts of water to one part livers. Then add two per cent caustic soda by weight of livers to the liver and water mixture. The caustic soda neutralizes any fatty acids present and also aids in the digestion of the liver tissue. Heat the entire contents of the kettle to 180° F., stir and blow live steam through until digestion is complete. This takes about twenty minutes. Draw off the entire contents of the kettle and send through a centrifuge (like a cream separator) which is capable of separating the oil from the gurry. Oil thus obtained is ready for shipment and needs no additional processing.

If a centrifuge is not available, the liver, oil and water mixture will separate upon standing for about twenty-four hours, and the oil will rise to the surface. Draw this oil off. You may need to filter this oil through a linen cloth in order to remove any suspended liver tissue.

For both of the above methods of extracting oil, be sure that you use only fresh livers, or those which have a red appearance. Do not use any livers that have turned black or dark brown, as one spoiled liver will ruin the entire batch.

Testing the Oil

Testing for oil content and Vitamin A potency is an essential step in the handling of livers. Since shark livers and oils are bought for their Vitamin A content, purchasers will want these tests made. It will also be helpful for you to know the probable value of your shipment before you attempt to market it.

Accurate tests such as the purchaser would require

can only be made in laboratories which are equipped to make such analyses. The tests which you yourself make can not be accurate, but even these rough analyses may serve as a guide to the quality and value of your product. It is not necessary for you to make tests yourself unless you wish to.

A good field testing kit is the **La Motte Apparatus for Measuring Vitamin A,** which is manufactured by the La Motte Chemical Products Company, Towson 4, Baltimore, Maryland, U.S.A. This kit contains six tubes of ammonia-copper sulfate solution which represent, by different shades of blue, specific Vitamin A values ranging from 5,000 to 100,000 units of Vitamin A per gram of oil. The kit also contains ampules of antimony trichloride reagent (25% solution in chloroform) to which you may add a drop of the oil you wish to test. A blue color will result which can be compared to the colors in the six tubes just mentioned. In this way you can estimate the approximate Vitamin A content of your liver oil. Full directions come with each kit, the cost of which is approximately $35.00 (U.S.) f.o.b., Baltimore, Maryland. The **Lovibond Tintometer** is a similar kit, manufactured by the Lovibond Tintometer British Drug House, Ltd., Graham Street, N.1., England. The approximate cost of this kit is £15. If these cost too much to purchase for individual use, it might be a good plan to have one available at your chief market for the use of all who are bringing their catch to that point.

Marketing Shark Livers and Oil

The United States is a ready market for Vitamin shark liver oil with its Vitamin A content. When you are ready to sell your product, send a quart sample of your total shipment (3 pounds if livers only) to be analyzed for Vitamin A content to the prospective purchaser in the United States. If the result of the analysis is satisfactory, the purchaser will arrange for a letter of credit to be opened for you at a local bank. This letter of credit will cover only a part of the total value of the shipment. You may collect this letter of credit by presenting the shipping documents to the bank as proof that

you have shipped the oil. When the total shipment has been received by the purchaser and the oil extracted and analyzed, a final settlement will be made.

The price which your oil will bring in the United States and the United Kingdom will depend upon its Vitamin A content. It is figured by the chemical companies in terms of cents (U.S.) or pence (U.K.) per million U.S.P. or International units of Vitamin A, and the price per million units is different for each range of potency. (2000 U.S.P. units are equivalent to 1600 International units). An average grade of oil will be worth around $4.75 per gallon f.o.b. a United States port.

At present there is no United States import duty on shark livers, but there is a 10% duty on liver oil if it is to be used for medicinal purposes, as of course it would be if purchased for its Vitamin A content. The United Kingdom duty on shark liver oil, meal and teeth is 10% ad valorem. Information concerning consular invoices and other documents which may be necessary may be obtained from United Kingdom Trade Commissioners or local Colonial Governments and from the nearest consular office of the country to which the product is to be shipped.

The following United States companies will be interested in buying shark livers and oil:

Atlantic Coast Fisheries, 111 John Street, New York.
Gorton-Pew Company, Gloucester, Massachusetts.
National Oil Products Company, First and Essex Streets, Harrison, New Jersey.
Silmo Chemical Company, Vineland, New Jersey.
National Bio-Marine Products Company, Fort Pierce, Florida.
Shark Industries, Inc., 840 East First Avenue, Hialeah, Florida.
Distillation Products, Inc., 755 Ridge Road West, Rochester, New York.
Technical Fisheries, Port Isabel, Texas.
Collett Corporation, Ossining, New York.
Vitamins, Inc., 809 West 58th Street, Chicago 21, Illinois.

E. R. Squibb & Sons Company, 30 Columbia Heights, Brooklyn, New York.

The following companies in England are interested in buying Vitamin A oil:

British Colloids, Ltd., Park Royal, London, N.W. 10.
Glaxo Laboratories, Ltd., Green Ford.
Lever Brothers, Port Sunlight.
Allen & Hanburys, Ltd., Ware.
Boots, Ltd., Nottingham.
C. T. Bowring Company (Fish Oil) Ltd., Water Street, Liverpool.

The following companies in Great Britain are interested in buying oil for technical purposes:

C. T. Bowring Company (Fish Oil) Ltd., Water Street, Liverpool, England.
Hugh Highgate & Company, Ltd., Paisley, Scotland.
Job Ivory & Company, Ltd., Water Street, Liverpool, England.
Prices Candle Company, Ltd., Bromborough, England.
Pool Works, near Birkenhead, Cheshire, England.
J. L. Seaton & Company, Ltd., Sculcoates, Hull, Yorkshire, England.
Isaac Spencer & Company, Ltd., Aberdeen, Scotland.

The names and addresses of Canadian companies which buy shark livers and oil may be obtained from the Trade Commissioner for the British West Indies and British Guiana, 37 Board of Trade Building, Montreal, P.Q., Canada.

Other Sources of Vitamin A

Vitamin A can also be obtained from the livers of fish other than shark. In general the livers are smaller but there are a few exceptions such as swordfish, marlin, sailfish, tuna, skates and rays. The livers of food fish which are caught in quantities should also be investigated as a source of this valuable product.

SECTION IV

SHARK HIDES—HOW TO HANDLE THEM PROFITABLY AND HOW TO ESTIMATE WHAT THEY ARE WORTH

Shark hides can be very profitable, with first class hides worth from $1.00 to $5.00 each, according to size. If the hides have not been handled properly, however, and are in poor condition, the price drops off rapidly, and it may not even be worth while shipping them.

Poor quality is generally caused by faulty handling and can be avoided. The two chief causes of poor quality hides are delay in skinning and careless handling. If you delay skinning the shark, the hide will begin to decompose and "sour spots" or decayed portions will result. If you skin the shark carelessly, "thin bellies" or "butcher cuts" will result, both of which lower the value of the hide.

The most valuable shark for its hide is the Nurse Shark (see Figure 33), but good quality hides of all other species can be sold at only slightly lower prices. You should remember, however, that small sharks (or those with less than 4½ feet overall length) or ones with bad fighting scars on the belly are not worth the trouble of skinning.

Specific instructions on how to skin, flesh, cure, pack and ship hides properly are given here and to get the best results you should follow them carefully.[5]

Skinning of Sharks

In skinning a shark, the opening is made along the back, not the belly. A really sharp knife is essential and it must be kept sharp. Do not try to skin the hide off cleanly, but leave a good layer of flesh on the hide. This flesh can be safely and easily removed in the next process described, the "fleshing".

[5] These instructions have been taken from *The Shark Fishing Industry*, 3rd ed., Ocean Leather Corporation, 42 Garden Street, Newark, N. J., 1932, pp 4-6. The Ocean Leather Corporation has very kindly given us permission to use this material.

First cut off the tail at the "knob" just before the tail fin starts; cut off all the other fins (Figures 5 and 6).

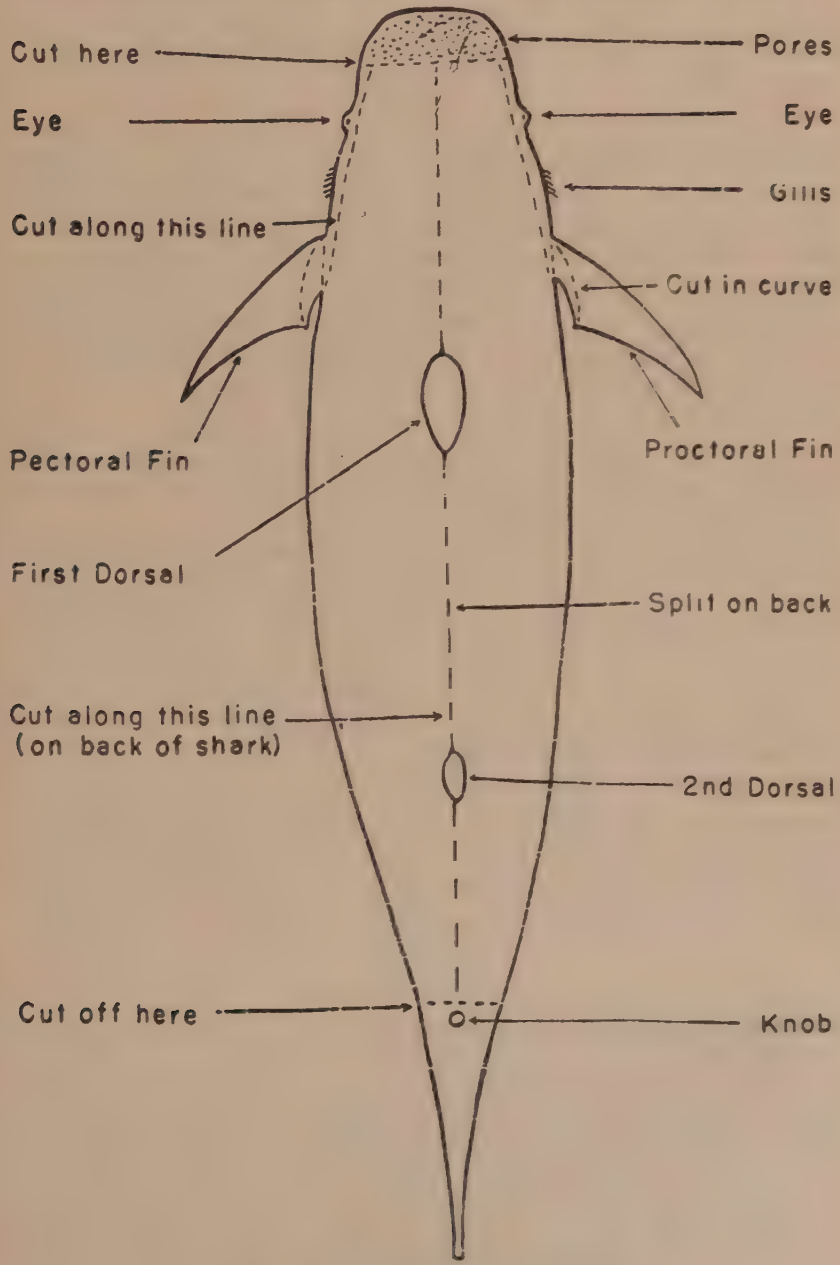


Fig. 5 - Top View

Insert the knife in the holes already made by removing the mid-back (dorsal) fins, and split the hide along the middle of the back (Figure 5).

Now make cuts around the gills and lower jaw (Figures 5 and 6).

Turn the carcass onto its belly and straddle it, facing towards the head of the shark. Seize the left side split of the hide near the head with left hand and hold it firmly while the right hand operates the skinning knife. The hide is peeled off by cutting it away from the carcass. Do not pull too hard as tearing the hide off will produce "thin bellies". Do not try to skin cleanly; leave plenty of flesh on the hide. Hold the skin taut since if it is left loose you will get butcher cuts. Always use the knife to free the hide, never try to tear it off.

When the left side is skinned off, turn around so that you face the tail end of the shark, and skin off the right side in the same manner.

After the hide is removed, wash it thoroughly in clean sea water, removing all blood and slime. Then put it into a large barrel containing brine (7½ pounds of salt added to 25 gallons of clean sea water, or 15 pounds of salt to 25 gallons of fresh water). This soaking will facilitate fleshing. A 50-gallon barrel, half full of brine, will hold from 15 to 20 hides.

An experienced man can skin a large shark in about 15 minutes, but it is best not to be in a hurry until you have become expert. Remember to keep the skin tight while skinning, leave plenty of flesh on the hide and free the skin by cutting not by pulling.

Fleshing

While fleshing can be done directly on the freshly skinned hide, this is better and more easily carried out after the hide has stood for 3 to 4 hours in the brine solution mentioned above. On no account should the hide be allowed to remain in this solution longer than over night.

Fleshing is done with a "beaming knife", a curved 16-inch blade with handles at each end. These cost about $7.50 (United States) and can be obtained from the Ocean Leather Corporation, 42 Garden Street, Newark,

New Jersey, and at other firms selling fishing gear. Information as to suitable knives may also be obtained

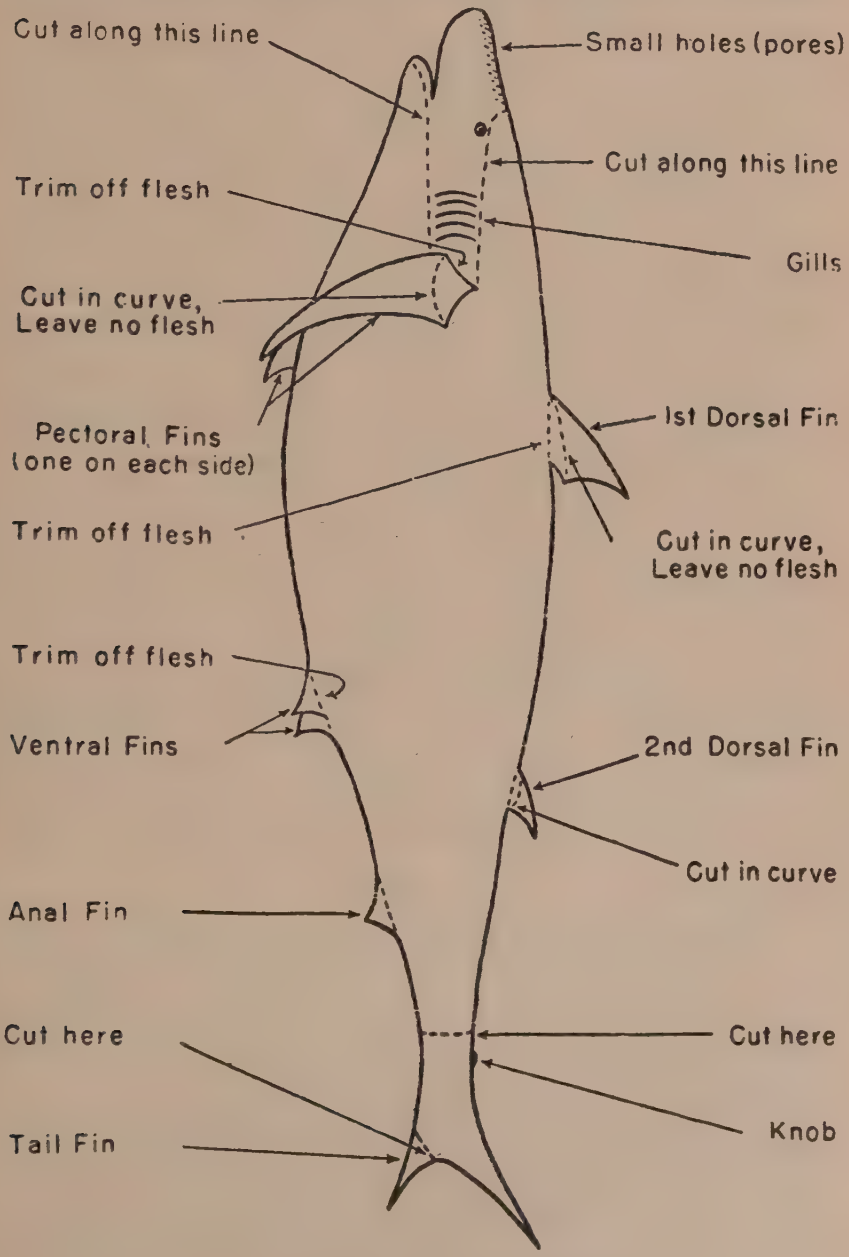


Fig. 6-Side View

from Sheffield Cutters Manufacturers Association, Sheffield, England, and from the Trade Commissioner for the British West Indies and British Guiana, 37 Board of Trade Building, Montreal, P.Q., Canada. The hide is stretched on a "beaming board", a stout board about 5 feet long and 3 feet wide with a curvature matching that of the beaming knife. The surface of this board must be smooth and kept free from particles of meat or dirt.

One end of the beaming board rests on the floor and the other end has a support which keeps it about the level of a man's waist. The flesher leans against the board and removes the surplus flesh by **pushing** the knife away from him (never pulling it towards him).

While the hide is on the beaming board, trim off the meat which may hang over after fleshing, especially around the fin holes. Make sure that the hide is cut back far enough to give clean, flesh-free edges as this will assist in preserving the hide. Next, split the tail end by cutting from the hole around the ventral fins and vent as shown in Figure 7, through the hole left by the anal fin and then in a straight line to the end of the hide. The resulting hide is shaped as in Figure 8. A good man can flesh and trim a hide in 10 to 15 minutes, but it is foolish to hurry until you are expert. The fleshed, trimmed hide should be immediately washed clean of all slime and blood in clean sea water. It is now ready for "curing", and this should be commenced without delay.

Curing

Curing is done on a platform with a slight slope so that the water and brine can run off. Sprinkle some salt on the inclined platform and lay the first hide, flesh side up flat on top of it. See that there are no creases or large folds in it. Spread a generous amount of salt over all portions of this flesh surface of the hide, and as a precaution, rub some extra salt along the cut edges. On top of this first hide, place the second one, flesh side up and treat it in the same manner; repeat this process until the pile is 3 or 4 feet high. Hides will take from 3 to 5 days to cure and should not be allowed to stand for more than

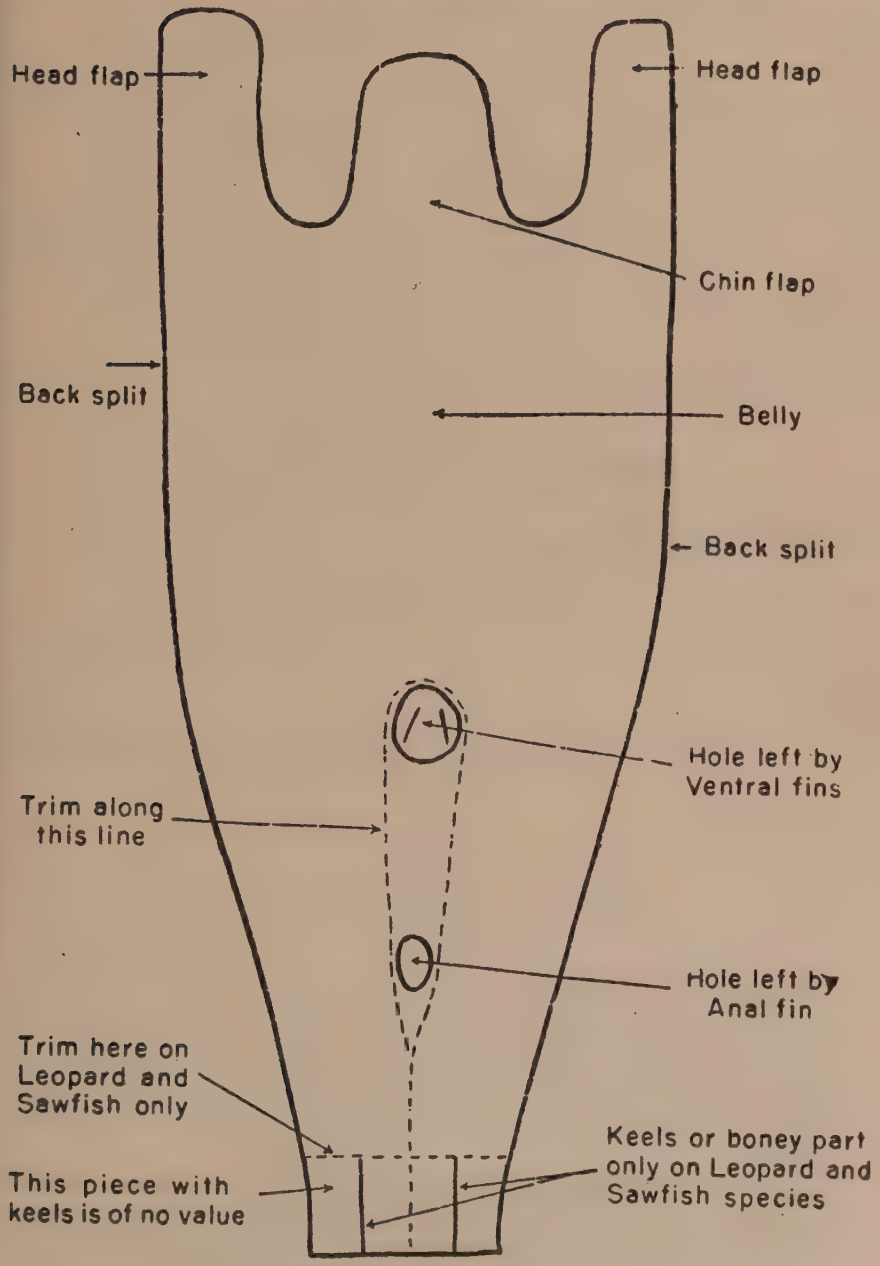


Fig. 7

Hide After Being Removed from Carcass

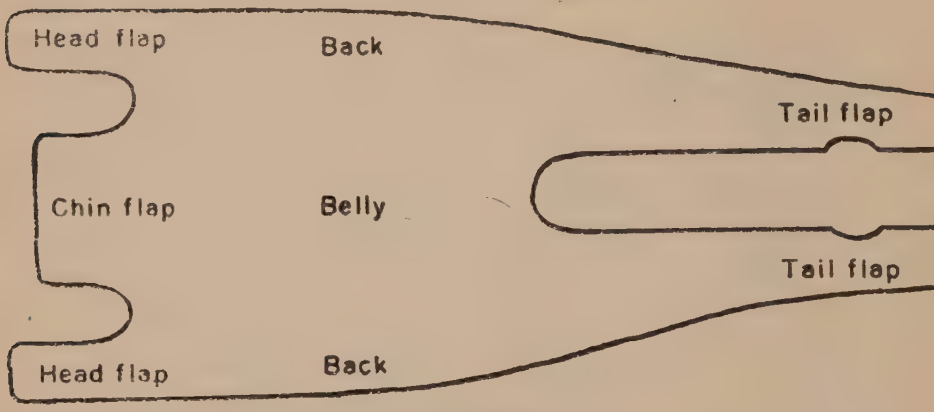


Fig. 8
Hide After Being Trimmed

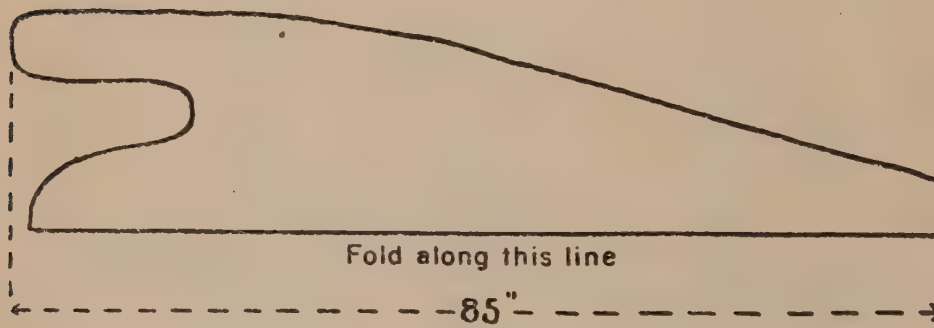


Fig. 9
Hide After Being Folded

6 days. On no account should the curing hides be exposed to rain or hot sun. Rain or fresh water will spoil the hides, and hot sun will wrinkle them and produce a "burnt" hide which is valueless. In localities where the night dew is heavy it is advisable to protect the hides from it.

Some people have obtained good results by using platforms in pairs. After the first day the hides are repacked in the same manner on the second platform but in the reverse order, the hide that was formerly at the bottom now being at the top. This complication is not essential but helps the process of curing.

In some localities ants and other ground insects may tend to attack the curing hides, but this trouble is great only if the hides have not been fleshed and trimmed properly. In any case the trouble can be easily avoided by any of the usual methods, such as standing the legs of the platform in water cups. Sometimes blowflies become a nuisance, and it is of importance that the hides should not be heavily fly-blown. It will usually be found that, if the curing is done a hundred yards or so from where the skinning, fleshing and trimming is done, this source of trouble is greatly reduced or eliminated. In any case it is advisable to have the curing platform well away from the scene of the fleshing, skinning and trimming. The platform should be protected from strong sunshine and either protected from rain or provision made for removal of the hides to shelter if rain is likely.

If during or after curing the hides show a tendency to become pink, or if after curing they develop damp "weeping" spots, the trouble is probably due to the salt used and salt from a different source should be tried. Once this pink color has appeared, everything, including the fleshing board and curing platform, should be thoroughly disinfected.

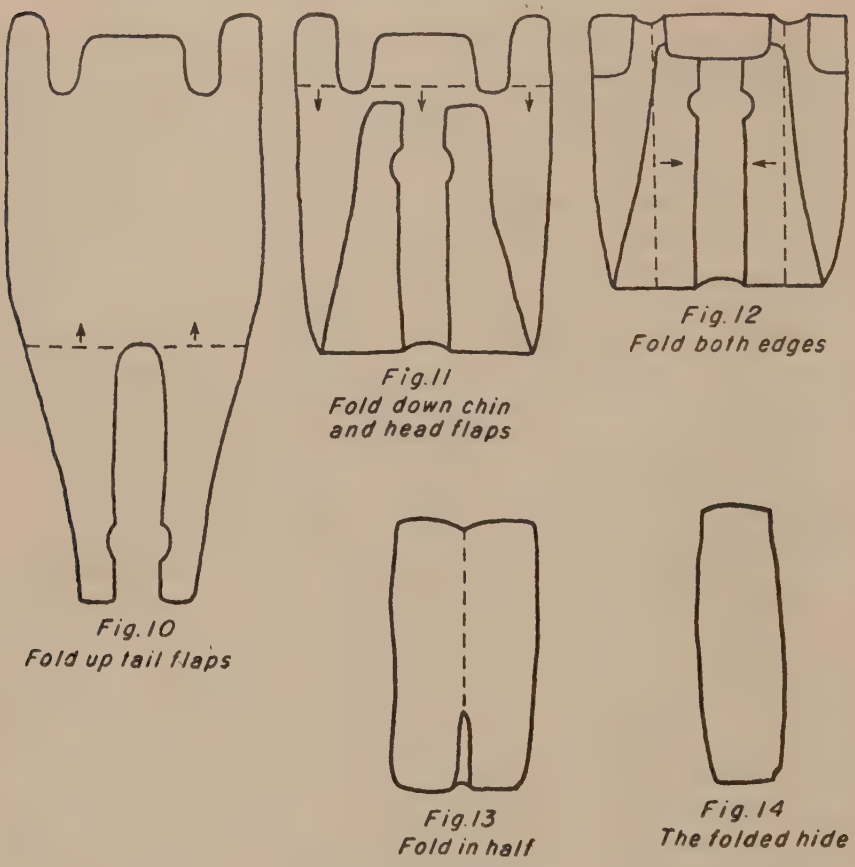
"Mineral Salt" is preferable to "Sea" salt, if you can get it, and it should not be too coarse. Medium-grade "Fisheries" salt is best. If "Sea" salt (for example Turks Island) or similar salt is to be used, only matured, well-dried salt with no sign of pink color should be used. Clean surplus salt can be used again, but dirty salt must be discarded.

After 4 or 5 days, the hides are ready for packaging and shipping.

Packaging and Shipping

Whatever salt remains on the cured hides should be shaken off and a new supply of clean salt put on the flesh side. The hides are then folded into flat bundles with the flesh side inwards as shown in Figures 10 to 14 to prevent the salt falling out. The flat bundles can now be rolled into round bundles and tied with string.

The packaging of these bundles will depend upon the



Folding the Hide

requirements of the shipping company and these should be ascertained in all cases. Aside from these requirements, almost any type of packaging that permits access of air is satisfactory, for example, burlap or sisal bags, sacks (sugar or flour), braided matting, barrels, etc. If watertight barrels are used, they must be open to the air (that is, bung left out).

Each package should be plainly marked with the initials of the shipper and plainly addressed and should be clearly marked "Shark Hides" and "Product of . . . . (insert country of origin)". Bills of lading should be sent on by post. Information concerning consular invoices and other documents which may be necessary may

be obtained from United Kingdom Trade Commissioners or local Colonial Governments and from the nearest consular office of the country to which the shark hides are to be shipped. At present there is no United States import duty on shark hides. There is no United Kingdom import duty on undressed hides; however, there is a 15% duty on dressed hides.

Estimating What Hides Are Worth[6]

Shark hides are bought on measurement and the method of measurement is indicated in Figures 8 and 9. The part of the hide over the tail itself and that over the head where the pores are is valueless. These parts are not recorded in the measurements nor paid for so that it is a waste of time skinning them off. The Leopard Shark and the Sawshark have two keels or bony ribs, one on each side running from the tail along the body for 4 to 16 inches. This part of the hide of these two sharks is valueless and should be cut off.

Defects That Reduce Value of Hides

(a) **Holes.**

These may be due to fighting scars, harpoon scars and butcher cuts. There is nothing you can do about the fighting scars, but the way to avoid butcher cuts has been described under skinning and fleshing.

(b) **Sour spots.**

This really means that the hide is rotten in some place. The most frequent causes of sour spots are not skinning soon enough after death, not curing quickly or well enough, poor quality salt or contact with fresh water.

(c) **Burnt hides.**

Deep wrinkles in the hides cannot be removed during the tanning process, and good marketable leather cannot be produced from hides with deep wrinkles. (Do not confuse these deep

[6] This section has also been taken from *The Shark Fishing Industry*. p. 6.

wrinkles, produced by faulty handling, with the naturally-occurring, shallow wrinkles, always found in the hide of the Tiger Shark.) Such hides are sometimes called burnt hides. Sometimes these deep wrinkles are caused by not laying the hides flat during curing, but more often by exposing the hides to hot sun.

Sometimes they may become burnt or overheated during the time they are in storage. To avoid this danger, they should be moved around occasionally so that the air can get at them.

A burnt hide is valueless.

(d) **Thin bellies.**

At certain times of the year some sharks, particularly the Nurse Shark, have "thin bellies." There is nothing that can be done about this.

Another cause of "thin bellies" is improper skinning. The hides are pulled off the sharks, leaving some of the hide substance on the carcass. This cause of "thin bellies" is easily avoided by following the instructions already given for skinning.

Selling Hides

The following firms in the United States are interested in buying or tanning shark hides:

Ocean Leather Corporation, 42 Garden Street, Newark, New Jersey. (Tanners).

F. C. Luthi and Company, Office—324 Baxter Bldg., New Orleans, Louisiana.

Joseph Fleischman, 1102 Franklin Street, Tampa, Florida.

National Fisheries Company, (New York and Nassau), Office—30 Church Street, New York City, New York.

Thompson Fish Company, Key West, Florida.

Southeastern Fur and Hide Company, 1465 King Road, Jacksonville, Florida.

Ocean Tanning Company, 41 Mason Street, Salem, Massachusetts.

Technical Fisheries, Port Isabel, Texas.
Rowland Marine Products Company, 14 Franklin Street, Salem, Massachusetts.

The following companies in England are interested in buying or tanning shark hides:

S. O. Rowe & Sons, Ltd., Tanner Street, Tower Bridge Road, London, S.E. 1.
R. & A. Kohnstamm, Ltd., Bekenham, Kent.
J. S. Deed & Sons, Ltd., Osnaburgh Street, London, N.W. 1.
W. Pearce, Billing Park, Northampton.
Charles F. Stead & Company, Ltd., Sheepscar Tannery, Leeds, Yorkshire.
Bevingtons & Sons, Abbey Street, Hermondsey, London, S.E.
C. B. Daniels, Ltd., Swanfield Street, Bethnal Green, London.

To give you an idea of the price you may expect, the latest price list of the Ocean Leather Corporation as of 1943 is given below:

Schedule of Prices and Classification on Nurse Shark Hides

Hides measuring	35″	and up to and including	49″	.85	cents ea.
ditto	50″	ditto	59″	1.10	" "
ditto	60″	ditto	64″	1.40	" "
ditto	65″	ditto	69″	1.80	" "
ditto	70″	ditto	69″	2.10	" "
ditto	75″	ditto	80″	2.45	" "
ditto	81″	ditto	90″	3.10	" "
ditto	91″	ditto	100″	3.65	" "
ditto	101″	ditto	110″	4.10	" "
ditto	111″	ditto	120″	4.75	" "

Schedule of Prices and Classification on Shark Hides of Other Species

Hides measuring	35″	and up to and including	49″	.70	cents ea.
ditto	50″	ditto	59″	.90	" "
ditto	60″	ditto	64″	1.15	" "
ditto	65″	ditto	69″	1.50	" "
ditto	70″	ditto	80″	2.00	" "
ditto	81″	ditto	90″	2.50	" "
ditto	91″	ditto	94″	2.90	" "
ditto	95″	ditto	104″	3.35	" "
ditto	105″	ditto	115″	3.90	" "
ditto	116″	ditto	125″	4.55	" "
ditto	126″	ditto	135″	5.50	" "

"f.o.b. New York, payment after arrival and inspection at our Tannery.

The hides are graded and the above prices apply as follows:

No. 1 Hides—Full price, plus 20% bonus. Perfect hides, having no holes and no sour (rotten) spots.

No. 2 Hides—Full price. Hides having not more than 3 holes, or not more than 1 sour spot.

No. 3 Hides—40% of full price. Hides having 4 or more holes or more than 1 sour spot.

No. 4 Hides—No value. Hides having numerous holes over the entire surface or having a large number of sour spots over the entire surface, making the hide worthless.

The above measurements are based on the length of the hides, skinned and trimmed as per our booklet of instructions. If the extra long tails are not cut off, deductions are made accordingly. Holes refer to butcher cuts, harpoon holes, fighting scars, etc.

The above is a general description of how the hides are graded, subject, however, to adjustments according to the length and width of the holes and the size of the sour spots. Generally speaking, if there are only a few cuts, or one or two sour spots on the edges of the hide, these can be trimmed out, but if there are a number of sour spots or holes in the center of the hide, it reduces the value over 50 per cent."

SECTION V

SHARK FINS AND SHARK TEETH—HOW TO HANDLE THEM AND WHAT THEY SHOULD BE WORTH

Part 1. Fins

All shark fins with a few exceptions are commercially valuable. They are chiefly in demand for making certain food specialties such as Chinese soups.

The fins which are valueless and which you should not include in your shipment are the side fins of the Sawfish Shark, the upper lobe of the tail of all sharks and all the fins of the Nurse Shark. Furthermore, the value of fins from sharks less than five feet in length is so small that it is not worth the trouble and expense of shipping them.

Cutting[7]

The fins should usually be cut off before skinning. Figures 5 and 6 show the location of the fins and where they should be cut. If they are cut correctly on a curve into the fins, very little meat will remain on them. They should then be cleaned free from meat and skin, washed in clean sea water and allowed to soak for a few hours, but not longer than over-night, in clean sea water. This makes final cleaning much easier.

After the fins have soaked for a time, they are taken out and the last traces of skin and flesh removed. They are now ready for drying.

Do not leave large pieces of bone on the fins. You will not be paid for the extra weight, and it will only reduce the grade of your fins.

Drying

The fins are spread **in the sun for drying.** Excellent spreads can be made from chicken wire or, where this is not available, from split bamboos or withes. They

[7] The following instructions for cutting, drying, packing and shipping fins have been taken from *The Shark Fishing Industry,* p. 10, and are used here with the permission of the Ocean Leather Corporation.

should be two or three feet above the ground and erected at some distance from where the skinning, fleshing and trimming of hides and fins is done or from any other offal that would attract flies.

The fins should never be exposed to rain. During the first few days they should be turned periodically, and they should be taken in at night and packed to protect them from the dew. Later, when the fins are partially dried, these precautions can be relaxed, but they should never be exposed to rain.

It takes about 14 days of good weather with plenty of sunshine to dry the fins properly. When properly dried they are absolutely stiff and hard and, when struck together, ring with a dry sound.

Packing and Shipping

Fins can be packed in bags, cases, barrels or almost anything, but do not use watertight or air tight containers. Pack the "Eastern Shark" fins separately from the Sawfish Shark fins. Always send complete sets of fins from each shark (except, of course, the ones already noted as valueless) as complete sets bring a better price.

Mark each package clearly with a number and the initials of the shipper and mark it "Fins" and "Product of . . . (insert country of origin)". Bills of lading and so forth should be sent on by air mail. Information concerning consular invoices and other documents which may be necessary may be obtained from United Kingdom Trade Commissioners or local Colonial Governments and from the nearest consular office of the country to which the fins are to be shipped. At present there is a United States duty of 1¼ cents per pound on shark fins.

Estimating the Value

A good sized shark will yield about 2 pounds of dried fins. These fins are usually sold through agents on a commission basis. As with all shark products, the price depends upon the quality, and this depends upon the freshness of the shark and the care with which the products are handled.

As an indication of the return which may be expected, the following is the latest quotation from the Ocean Leather Corporation:

> "The present market price of the first grade fins is 70 cents per pound and of the second grade fins 15 cents to 25 cents per pound, f.o.b., New York. The second grade fins are the smaller size fins and those which are not properly trimmed and dried. At present there is a strong demand for Shark Fins and we are in a position to dispose of them at favorable prices, promptly."

It should be noted that there is a considerable demand for shark fins by the Chinese residents of the Caribbean. The prices that can be obtained locally should be investigated.

Part 2. Teeth

Good-sized, sound sharks' teeth and sharks' jaws and backbones, either merely cleaned or made into novelty items, have always been in demand by tourists. While these novelty items are obviously not a reason for shark fishing, it takes little trouble to make extra profit from them once the shark has been caught for other purposes.

According to the most recent quotation from the Ocean Leather Corporation, good-sized sound sharks' teeth sell for 50 cents (United States) per 100. Since a fair-sized Leopard Shark may yield from 150 to 200 sound teeth from its seven rows, you will receive from $1.50 to $2.00 (United States) from the teeth alone. In some species of sharks, however, the teeth are too small to be of any value. They are also often decayed and teeth in back rows are often hollow.

Teeth can easily be removed by boiling the jaws for a short time in water to which a small amount of caustic soda has been added.

SECTION VI

SHARKS AS A SOURCE OF HUMAN FOOD

Most shark flesh if properly handled can be made into tasty and wholesome food. It can be used fresh or salted. Well prepared salted shark is equal in flavor and food value to good-grade salt cod. As a step towards overcoming the popular prejudice against it, the meat is usually cut into small pieces and is marketed under some trade name such as "Cuban Cod", "Victory Cod", or just as "Dry-Salt Fish".

Unfortunately, there is a great deal of prejudice against eating sharks in the West Indies, but most of this is due to ignorance. Shark meat is freely eaten by most fishermen, and in England shark flesh finds a ready market as "fish and chips."

There are, however, other real objections. Shark meat "goes off" even more quickly than fish flesh. You should, therefore, never attempt to prepare shark meat for human consumption unless the shark is absolutely fresh. Shark meat also has a characteristic smell and tends to leave a dry taste on the tongue, but both of these objections can be largely removed if you prepare the shark in accordance with the following methods.

Handling

For human food, the shark must be absolutely fresh, whether it is to be eaten fresh or as dry-salt fillets. You should be careful not to bruise it, throw it about or let it remain in the sun. Nor should shark meat, if it is to be used as human food, be left in a metal container because a chemical change will take place. Hammerhead Sharks, very large sharks, or sharks feeding on sewers or abattoir outlets should never be used. It is desirable, too, to avoid using the "dark" meat, for while it is not unwholesome, it tends to "go off" more quickly, and it has more of the characteristic "shark" smell and taste. There is also violent prejudice against it. The dark meat, together

with the bones and other parts, can be converted into fish meat and fertilizer (see Section 7).

Immediately after skinning, therefore, separate the white meat from the dark meat. Cut this white meat the long ways, into fillets, 9 by ½ inches. These fillets should be thoroughly washed in either clean salt water or clean brine (4 pounds salt to 10 gallons clean fresh water).

If ice or cold storage is available, the fillets should now be iced down for 24 hours and should not be packed too closely or kept below the freezing point. This will remove the "shark" smell and taste. The fillets are then soaked in clean brine and stirred for 2 hours. After this process they are ready for sale as fresh fillets or for dry-salting.

If ice is not available, most of the characteristic smell and taste can be removed by soaking, with constant stirring, in the brine solution for 6 hours. It is preferable to change the brine after three hours. After the 6 hours, wash each fillet with clean brine, and it is now ready for sale as fresh fillets or for dry-salting.

Fillets prepared in this way must be eaten at once or kept on ice or in cold storage. Fresh shark fillets taste best boiled, but the popularity of the English "Fish and Chips" shops indicates that they taste well fried, too.

If the shark fillets are not to be eaten as fresh fillets, they should be dry-salted, and this process must be commenced immediately.

Dry-Salting Shark Fillets—The Salt to Choose

In salting, the quality of the salt is of great importance. Mineral salt or "sterilized" salt is safest. If neither of these is available and you have to use unsterilized sea salt, insist on mature, dry salt—that is, salt that has been stored for a year since it was made. It must not have even the faintest tint of pink color. Sea salt can be improved by a few hours drying on the drying pan described for the preparation of "Fish Meal" (see Section (7). All salt should be fairly fine, medium grade. "Fisheries" salt is very satisfactory.

If during salting and drying or during storage, your

product develops reddish pink pieces and "weeps", it is probably your salt which is causing the trouble. The only thing to do is to sterilize everything. Change to a mineral salt or, if this is not possible, heat the salt longer and at a higher temperature on the drying pan. Above all, take no chance of contamination with the spoiled fish. Act as though you were dealing with scarlet fever and remove or disinfect all sources of infection.

Above all, never be sparing with your salt. The process known as "corning" in which a mere sprinkling of salt is used is all too common in the West Indies. This skimping on the salt produces a very poor product which will not keep for more than a few days.

Salting

Salting should be done on a sloping platform, protected from sun, rain, dew and insects, and about 1 foot clear of the ground. It should be placed at some distance from the place where sharks are skinned, hides fleshed or where any offal is to be found. If ground insects prove troublesome these can be eliminated by standing the legs of the platform in tins of water. The platform should be made of solid boards with a number of ¼-inch holes bored through them.

On top of the platform spread a layer of salt. On this layer of salt, spread a layer of fillets, each of which has been well rubbed in salt. The layer should be only one fillet thick. On top of this layer of fillets spread a layer of salt and then another layer of salt-rubbed fillets, another layer of salt, then another layer of fillets and so on till the pile is 3 or 4 feet high. On top of the pile of fillets, place some extra salt and a few heavy flat pieces of wood.

After the pile has been in place for 24 hours, it should be unpacked and repacked as before, using fresh salt, but in the reverse order, now placing the fillets that were at the top at the bottom. This repacking can be simplified if the platforms are built in pairs and only one used at a time.

Leave the pile now for 3 or 4 days longer. If possible, wait for a bright, dry day with little dampness in the air and a good breeze to begin the next step, the drying.

Drying

After the salting is completed, shake off the loose salt and wash the fillets. Fresh water is preferable, but if this is not available, clean sea water will do. Do not leave the fillets lying in the water; the washing of each fillet should not take more than a half minute.

The drying process is helped if, at this stage, the fillets are fed through a pair of rollers and squeezed. The squeezing should not be too severe and should not reduce the thickness of the fillet by more than a half. Two simple wooden rollers will do the trick as in a simple, hand operated clothes mangle, except that the gap between the rollers should be greater. Alternatively, a simple hand press, like that described in the next Section 7 (see Figure 16) for pressing fish meal, will do. This pressing merely assists the drying and makes the product look more tidy. If rollers or presses are not available, this step can be left out. Now start the drying.

The best drying is what is known as "shade-drying"—that is, the drying fish should be laid out in a good breeze but protected from the hot sun. The best drying racks are made from 1 inch mesh chicken wire, but if this is not available, quite satisfactory ones can be made from split bamboo, withes, or the midribs of coconut frond. The racks should allow the freest passage to air. They should be at least 1 foot clear of the ground and erected in a place and manner so that they will not be troubled by insects. A satisfactory shade from strong sun can be made from coconut boughs or palm leaves but should be placed well above the drying racks, so as to allow a free draft. A good draft of air helps with the drying more than anything else.

The salted, washed fillets (also pressed if possible), are laid out on these racks, no one fillet touching another. For the first day of drying, they should be turned every two hours, for the second day every 4 hours, and from then on, once every six hours. The fillets must be brought in and stacked every night or the dew will spoil them; and they should be brought in whenever there is any likelihood of rain. If the shade-drying seems to be taking too long, the fillets can be exposed for limited periods to

the direct sun, particularly in the morning and late afternoon, but this should not be done unless necessary. If rainy weather sets in before the drying is finished, the fillets should be salted and stacked; and when dry weather comes again the salt shaken off and drying continued. The time for drying varies greatly with the dampness of the air, the amount of draft, the temperature and other factors. The only way to tell when drying is complete is to examine the fillets. When they are properly dried, it should not be possible to press a thumb mark into them easily and when struck together they should "sound dry". Under good conditions the drying should take about 6 or 7 days.

In most parts of the Caribbean there are definite rainy seasons. It is best not to attempt to shade-dry fish during these periods.

Packing

After drying is completed, each fillet should be dusted with a mixture of fine mineral salt to which 10 per cent of corn meal has been added. They should then be packed, preferably in waxed paper, in lots of about 25 pounds and kept in as dry and cool a place as can be found.

Almost any kind of container is suitable and the type chosen will depend on how it is to be handled, and the requirements of shipping companies, etc. Mat hampers woven from local materials are very satisfactory.

The resulting product should be up to the standard of good grade dry salt cod.

Remember:

(1) Use **only absolutely fresh sharks** and get on with process without delay; shark meat "goes off" more quickly than fish flesh.

(2) Do not attempt to use Hammerhead Sharks, very large sharks, the dark meat or sharks feeding on sewer or abattoir outlets, for human consumption.

(3) Always keep everything clean and sanitary.

(4) Use good, fisheries-grade salt and plenty of it.

(5) Shade-dry the fish and protect the drying fish from rain and dew. Do not attempt to shade-dry fish in the rainy season.

SECTION VII

SHARKS AS A SOURCE OF FISH MEAL FOR POULTRY AND STOCK AND AS A SOURCE OF FERTILIZER

Part 1. Fish Meal

Fish meal is now in very great demand. It is an extremely valuable source of protein for feeding stock. At one time people were afraid to use it because they were afraid that it would give a "fishy" flavor to the meat, milk and eggs. We now know that this is not true. Of course, if you feed enormous quantities of the material to animals, this "fishy" flavor may appear, but since fish meal is such a concentrated source of protein, it should be used sparingly anyway.[8]

Fish meal can be made from the parts of the shark (and other fish) which are unsuitable for other purposes, and the general scheme for preparing it is very simple. **Absolutely** fresh scrap meat, offal and bones of the shark are boiled in water to cook the flesh and get rid of the oil. The cooked scrap is then pressed to remove the rest of the water and oil. Next it is dried over a fire, taking care to avoid scorching, and lastly, the dried material is ground up to a coarse powder. To carry this process out, a few pieces of simple equipment are necessary. It will now be explained how you can make these pieces of equipment simply and cheaply with materials at present available to you. These pieces of equipment are (a) a heater, (b) a boiler, (c) a press, (d) a dryer, and (e) a grinder.

(a) Heater and (b) Boiler. (Figure 15)

You can make the heater and boiler very easily out of a 40 to 50-gallon steel drum. To make the heater cut

[8] Fish meal can be used as feed in the following amounts:
Cattle—2 pounds per day for every 1,000 pounds live weight.
Pigs—1/4 to 1/2 pound per day according to weight.
Sheep—1/10 to 1/5 pound per day for every 100 pounds live weight.
Poultry—not more than 10% of total ration for hens, and not more than 5% of total for chicks.
For further details consult your Agricultural Department.

off the bottom third of the drum, add a chimney to it, cut a door for adding fuel and punch air holes around the bottom. On the top, to support the boiler, either

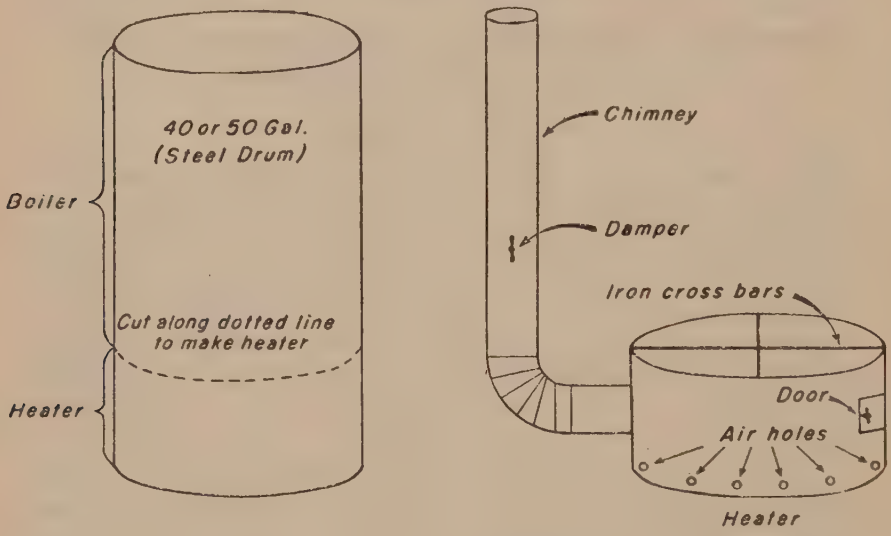


Fig. 15

Boiler and Heater

place a piece of black iron sheet or two pieces of stout iron bar crossed. This heater will work well with wood or charcoal.

The other two thirds of the drum, turned upside down, will do for the boiler and will hold about 25 to 30 gallons.

(c) Press. (Figure 16)

The press consists of a set of boxes in which the material to be pressed is placed and a frame in which these boxes are pressed.

Make 5 or 6 boxes (Figure 16) using 1½ inches or 2 inches thick wood. The boxes should be 3 feet x 2 feet x 3 inches inside measurement. The lid should be reinforced and just fit smoothly inside the box. On the lid attach two pieces of 3 x 3-inch wood just a little shorter than the length of the lid—about 2 feet x 10 inches.

Through the sides and ends of the boxes, make a number of holes through which the liquid can escape as it is squeezed out. These holes should start from the bottom of the box and be 2 inches high. As the sides are 3 inches

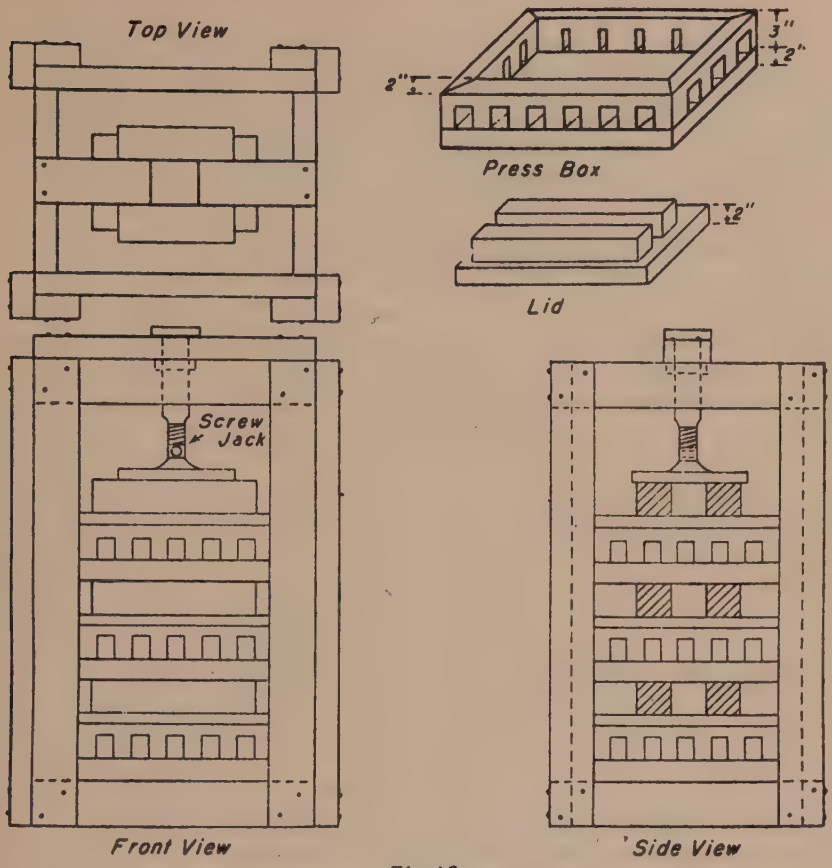


Fig. 16
Press

high, this will leave 1-inch solid wood above. These holes are made wider outside than inside so that they will not get stopped up. On the inside the holes should be 1/4 of an inch wide and on the outside 3/4 of an inch wide.

A good sturdy frame of 2 x 4-inch lumber is made of such a size that the boxes just fit snugly inside. Near the bottom of the frame are stops which prevent the bottom box from going through. At the top of the frame is either an ordinary large screw-jack or a stout, long-handled lever, to give the pressure for squeezing the meal in the boxes. At the bottom of the jack is attached a 3-inch board 2 x 2 feet which pushes down squarely on the 3 x 3-inch bars on the lid of the top box.

(d) Dryer. (Figure 17)

The dryer consists of two large trays but quite shallow. When in use, the bottom tray rests on the heaters and the top tray rests on the bottom one. Each tray can be made of sheet iron, black iron or galvanized "corru-

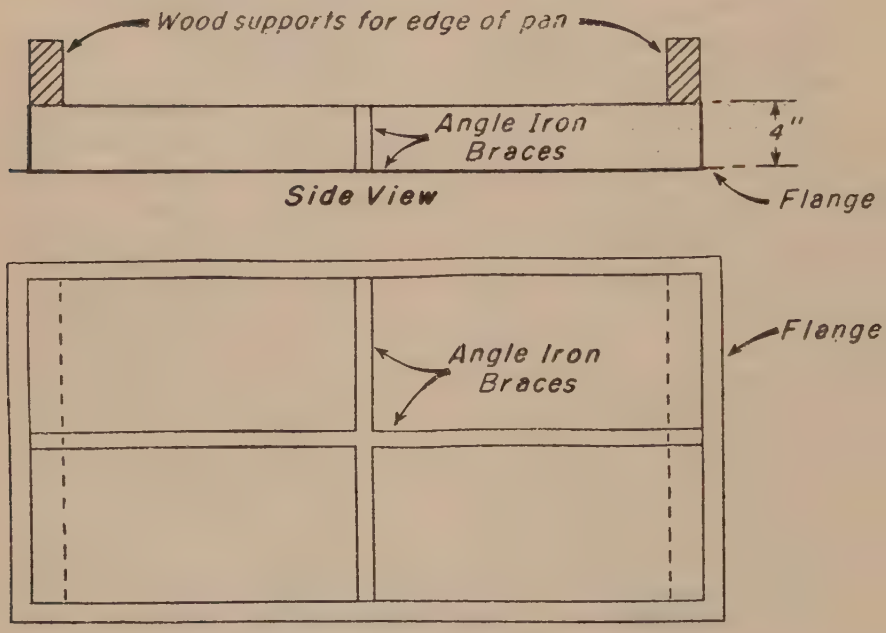


Fig. 17

Dryer

gated" iron rolled out flat. A good-sized tray is made by riveting two 6 x 2½-foot sheets together, giving one sheet about 6 x 4 feet.

For the lower tray, turn up the edge 4 inches with a 1-inch flange for the upper tray to rest on. The tray can be stiffened with angle iron or iron bar riveted in place. If stiff iron bars are continued as a cross over the top of this tray, this will better support the upper tray.

The upper tray is made in the same way as the bottom one except that the turn-up need be only 3 inches with

no flange, and it can be stiffened by nailing 3 x 2-inch wood round it (on the inside). If the lower pan has been fitted with iron bars crossed over the top, there is no need to stiffen the bottom of the upper tray.

When in use, the top pan is placed on the bottom pan, and this is supported on two of the heaters described in (a) above. For better and more even heat, a piece of sheet iron should be placed between the heater and the bottom of the lower pan. If it is to be used as a water heater it must be made water tight and should be made of galvanized material. It should also be fitted with two steam escape pipes 2 inches in diameter by 1 foot long to take the excess steam away from the drying meal. When used as a water heater, the bottom bath should not be filled more than half full, and care should be taken to see that it does not boil dry.

If the lower pan is to be used as an air heater, it is best to make it of black iron. In this case, care must be taken to avoid overheating the drying meal.

In any case, galvanized iron is the best material for the upper pan, although this is not essential.

(e) Grinder. (Figure 18)

A good grinder can be made from a stout barrel with both ends intact. Take a piece of sound, square lumber, about 3 x 3 inches, and around the center of each end of the barrel cut a hole to fit this bar tightly. Pass the bar of 3 x 3 inches through both holes so that it sticks out about 15 inches at each end. A couple of stout nails driven into the bar of wood will hold the barrel in this position.

About 6 inches clear of the barrel at each end, round the 3 x 3-inch bar for a distance of about 3 inches.

Next cut a hole about 6 x 6 inches in the middle of the side of the barrel. This is for putting things into and taking them out of the barrel. It must be fitted with a snug cover that will not fall off or out.

Take reasonably heavy pieces of lumber and make a frame similar to the one shown in Figure 18. Let the rounded part of the bar through the barrel turn in a notch cut in the lumber as shown in the Figure. Nail a strip of leather, metal or lumber over the top of the notch

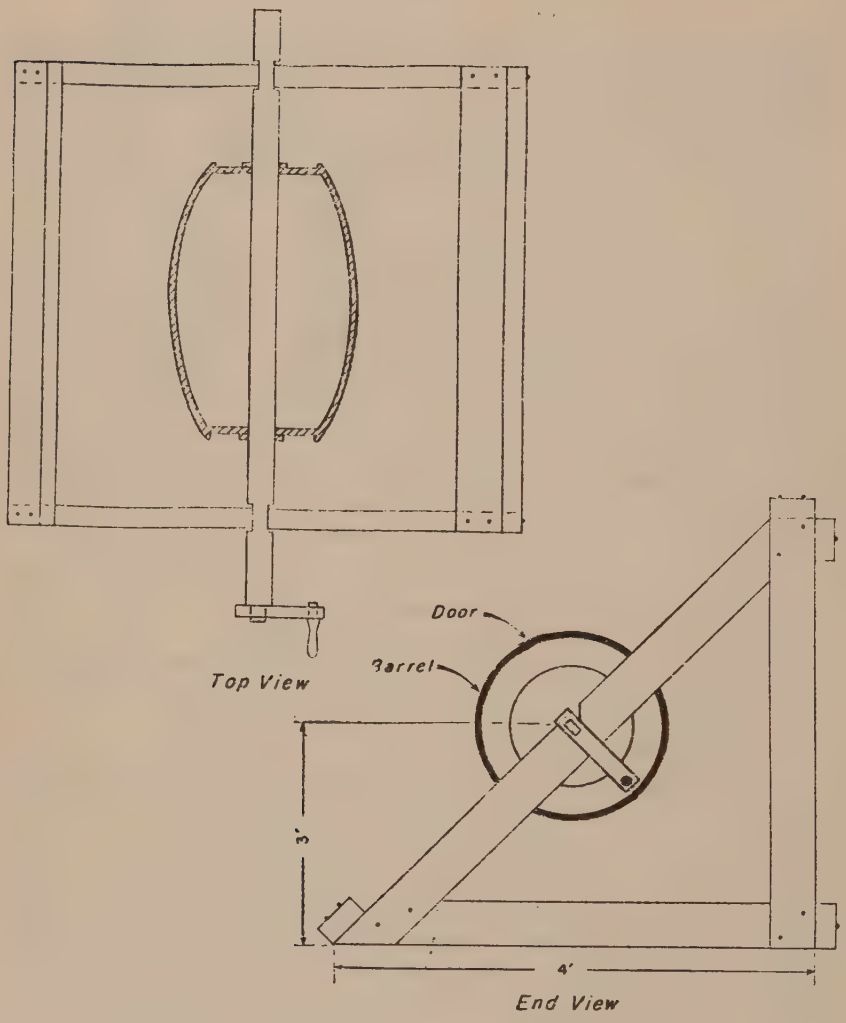


Fig.18
Grinder

to prevent the bar from slipping out. A suggested bearing to place in this notch can be made from a piece of tin or by nailing in a piece of bacon rind.

On one end of the bar through the barrel, now the axle, fit a simple handle for turning the barrel.

For grinders inside the barrel put several good, heavy solid stones. These should be as nearly round as possible. The best type of stone to use is heavy volcanic

stone or granite. In some places where such stones do not occur naturally they can be found where ships have dumped ballast. Ordinary coral rock is useless, but hard limestone will do for want of something better. In some places round suitable pieces of scrap metal are available.

If the ends of the barrel are not completely firm, they should be strengthened with wood around the hole through which the axle passes.

Of course these instructions need not be followed strictly. Where one thing is not available there is always something else that will do. With a little thought and imagination, this equipment can be built anywhere at little cost.

The method described above is very simple. There are many elaborate machines for making fish meal. At the present time this machinery would be difficult if not impossible to get. Besides, even the smallest set of equipment would cost thousands of dollars, and to make it pay you would have to handle between 3,000 and 6,000 tons of scrap a year. If you ever reach this stage, it will be worth your while to make inquiries. The simple equipment described above requires a good deal more labor than the modern machines but it produces just as good fish meal.

Making Fish Meal—Boiling and Cooking

Put about 12 gallons of water into the boiler and bring it to a boil. Add about 150 pounds of chopped meat and refuse and broken up bones. Cook for 20 to 25 minutes with occasional stirring. Allow to cool for 10 minutes without stirring. Draw off the surface water.

At one time it was thought that oil in fish meal was harmful to stock; it is now known that with the possible exception of growing chicks, this is untrue and that the oil is an advantage in feed. As this fact has been known for only the last 10 years, you will still find people who will not buy meal with a high oil content. For this reason and for the reason that low oil meal is more easily prepared and stored, keep your oil content down—if necessary by prolonging the boiling of the scrap.

Take out the cooked material (a wire basket of about

1/8-inch wire mesh is often useful here). Pick the flesh off the bones and pack the flesh and the bones into separate boxes for the press.

Pressing

Press the material to get out as much of the liquid as possible. A slow pressure is best and when the final pressure is reached, allow it to remain there for 10 minutes to drain.

Drying

Spread the pressed material on the upper part of the dryer. While it is drying rake it about and make sure that it does not scorch. The flesh will dry out faster than the bones so it should be removed first by shaking through a 1/2-inch sieve. Leave the bones on the drier till they are crisp and brittle. Total drying should take from 4 to 5 hours.

Grinding

Transfer the material to the grinding barrel. A good sized barrel will hold from 15 to 20 pounds of dried material, and it should not be filled too full. The grinding takes about 10 to 15 minutes but bones may take longer.

The yield is about 1/6 to 1/8 the weight of the original scrap.

If the process is done thoroughly, the protein content should be between 50% and 60%, and the water content should be not more than 8%. The resulting meal is of good quality and equal in value to most of the meal which is on the market.

Sale, Storage and Shipping

There should be a ready market throughout the Caribbean for well-prepared meal. On the Atlantic coast of the United States, fish meal is sold according to the percentage of protein it contains. The present ceiling price is $1.21 per ton for each percentage of protein. That is, if the protein value is

50%—Price per ton, 50 x $1.21 equals $60.50 per ton.

60%—Price per ton, 60 x $1.21 equals $72.60 per ton.

Good meal should be worth at least this in your own

locality. Inquire from your local Agricultural Department.

Fish meal must be kept absolutely dry and in as cool a place as possible. It should be packed tightly and not exposed to the air more than necessary.

To make good fish meal remember:

(1) Use only fresh material. Do not waste time with decaying stuff.

(2) Keep everything clean and sanitary. Wash out the boiler and the drying tray at least once a day.

(3) Get all the oil and water out that you can before drying. Although the oil is really useful stock food, some people do not know this yet and will not buy meal with a high oil content.

(4) Dry thoroughly. You will not get paid for water you leave in, and it will tend to make the meal become mouldy and spoil. At the same time, do not let the meal scorch and become too dark.

(5) Store in a dry place and do not expose to air any more than you have to.

Part 2. Fertilizer

Shark-scrap fertilizer is really poor-grade fish meal. To prepare it, therefore, you should follow the same procedure as that described for fish meal in Part I of this Section. In general, all the handling precautions which were given for fish meal will apply. Fertilizer, however, need not be quite so carefully prepared; it can be sun dried instead of on a drying pan, although this is not recommended. Some authorities consider that oil is bad in fertilizer, so you should keep the oil content low.

There should be a keen local market for this kind of fertilizer if it is properly handled. Since it sells for from 50% to 60% of the price for fish meal, it is obviously to your advantage to make meal wherever possible. If, however, the scrap material is not absolutely fresh and good, you should make fertilizer.

APPENDIXES

APPENDIX A

Figures 19, 20, 21

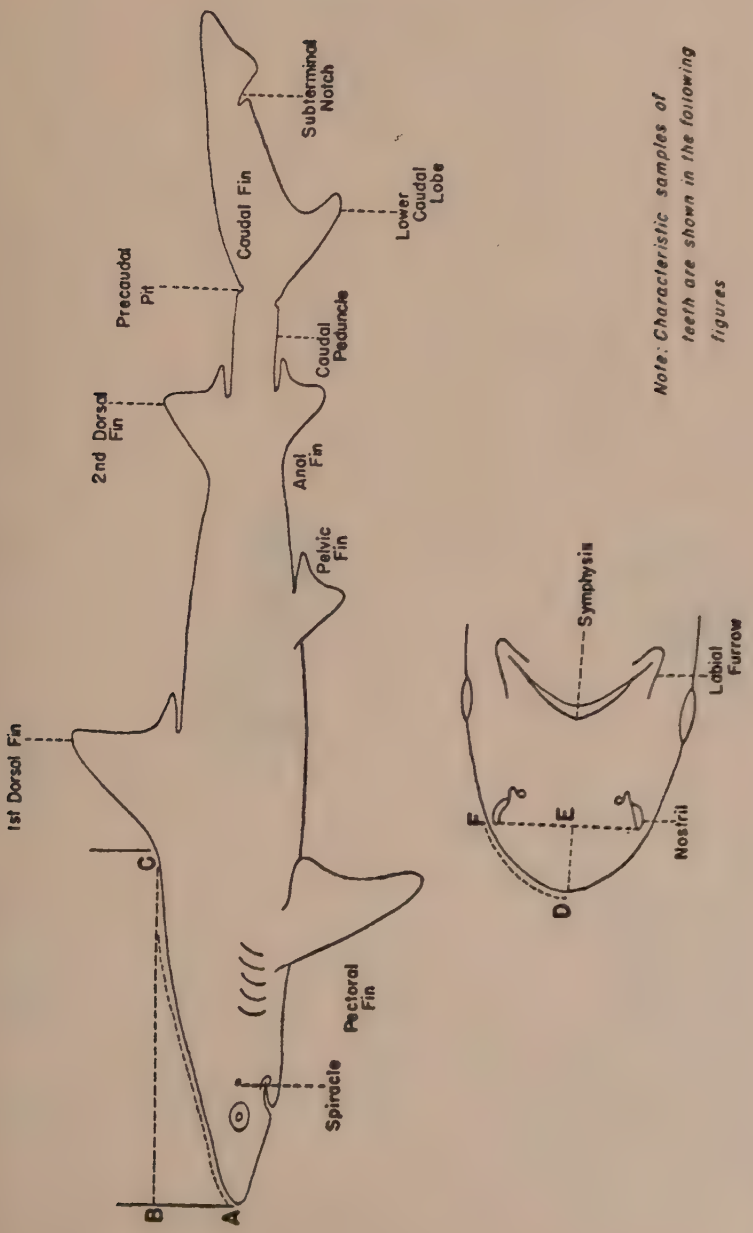


Fig. 19 Typical shark, showing features frequently used in keys and descriptions

Fig. 20 Eye of Sphyrna diplana (above) showing nictitating or "winking" membrane; and eye of Mustelus canis (below) showing sub-ocular fold

Fig. 21 Pelvic fins of (A) female shark, and of (B) male shark

APPENDIX B

Names of Shark Species in Alphabetical Order

Popular Name	Scientific Name	Fig. No.
Angel Fish	*Rhina dumeril*	56
Black-Bellied Dog Fish	*Etmopterus hillianus*	54
Bonnet Shark	*Sphyrna tiburo*	48
Brown Shark	*Eulamia milberti*	26
Bull Shark	*Eulamia leucas*	27
Cat Shark	*Scyliorhinus torrei*	40
Common Hammerhead	*Sphyrna zygaena*	49
Common Smooth Dog Fish	*Mustelus canis*	39
Common Spiny Dog Fish	*Squalus acanthias*	52
Common Thresher	*Alopias vulpinus*	37
Cuban Spiny Dog Fish	*Squalus cubensis*	53
Dusky Shark	*Eulamia obscurus*	25
	Eulamia falciformis	23
Florida Dog Fish	*Mustelus norrisi*	38
Great Black-Tipped Shark	*Eulamia maculipinnis*	29
Great Blue Shark	*Prionace glauca*	43
Great Hammerhead	*Sphyrna tudes*	51
Hammerhead	*Sphyrna diplana*	50
Lemon Shark	*Negaprion brevirostris*	41
Luminous Shark	*Isistius brasiliensis*	55
Mako	*Isurus oxyrhincus*	35
Man Eater	*Carcharodon carcharias*	36
Night Shark	*Hypoprion signatus*	47
Nurse Shark	*Ginglymostoma cirratum*	33
Pigmy Dog Fish	*Triakis barbouri*	44
Sand Shark	*Carcharias taurus*	34
Seven-Gilled Shark	*Heptranchias perlo*	30
Sharp-Nosed Shark	*Scoliodon terrae-novae*	46
Silky Shark	*Eulamia floridanus*	22
Six-Gilled Shark	*Hexanchus griseus*	31
Small Black-Tipped Shark	*Eulamia limbatus*	28
Smooth-Toothed Shark	*Aprionodon isodon*	45
Tiger Shark	*Galeocerdo cuvier*	42
Whale Shark	*Rhincodon typus*	32
White-Tipped Shark	*Eulamia longimanus*	24

APPENDIX C

Figure 22

Family Eulamidae, Requiem Sharks.
Genus *Eulamia.*
Figure 22. Eulamia floridanus, Silky Shark.

Description: *E. floridanus,* like *falciformis* (Figure 23), belongs to the ridge-backed subdivision of the genus. The free rear tips of its second dorsal and anal fins are very long and its teeth are similar. It can easily be distinguished from *falciformis,* however, by its much longer pectorals (nearly or just as long as the head), its smaller eye (its diameter only 1/4 to 1/5 as long as the distance between the nostrils), and its narrower-tipped snout.

Color: Dark gray to black above; dirty white below except that the lower surfaces of the pectorals are dusky at the tip.

Size: One of the larger members of its tribe, all specimens so far reported having been between 8 feet and about 10 feet long.

Habits: All that is known of its habits is that it is most often taken (on set lines) in depths of 100 feet or more. Presumably it is a fish eater.

Range: Although it has only been about a year since this species was given a scientific name, it undoubtedly occurs throughout the tropical belt of the western Atlantic. It is already known from Puerto Rico, from both coasts of Cuba and from southern Florida. Large numbers have recently been taken off Havana, while, off Salerno, Florida, as many as sixty adults have been taken recently in a single day. Fishermen are familiar with it as the "Silky Shark," a name appropriate because its scales are so small that its skin feels smooth to the touch.

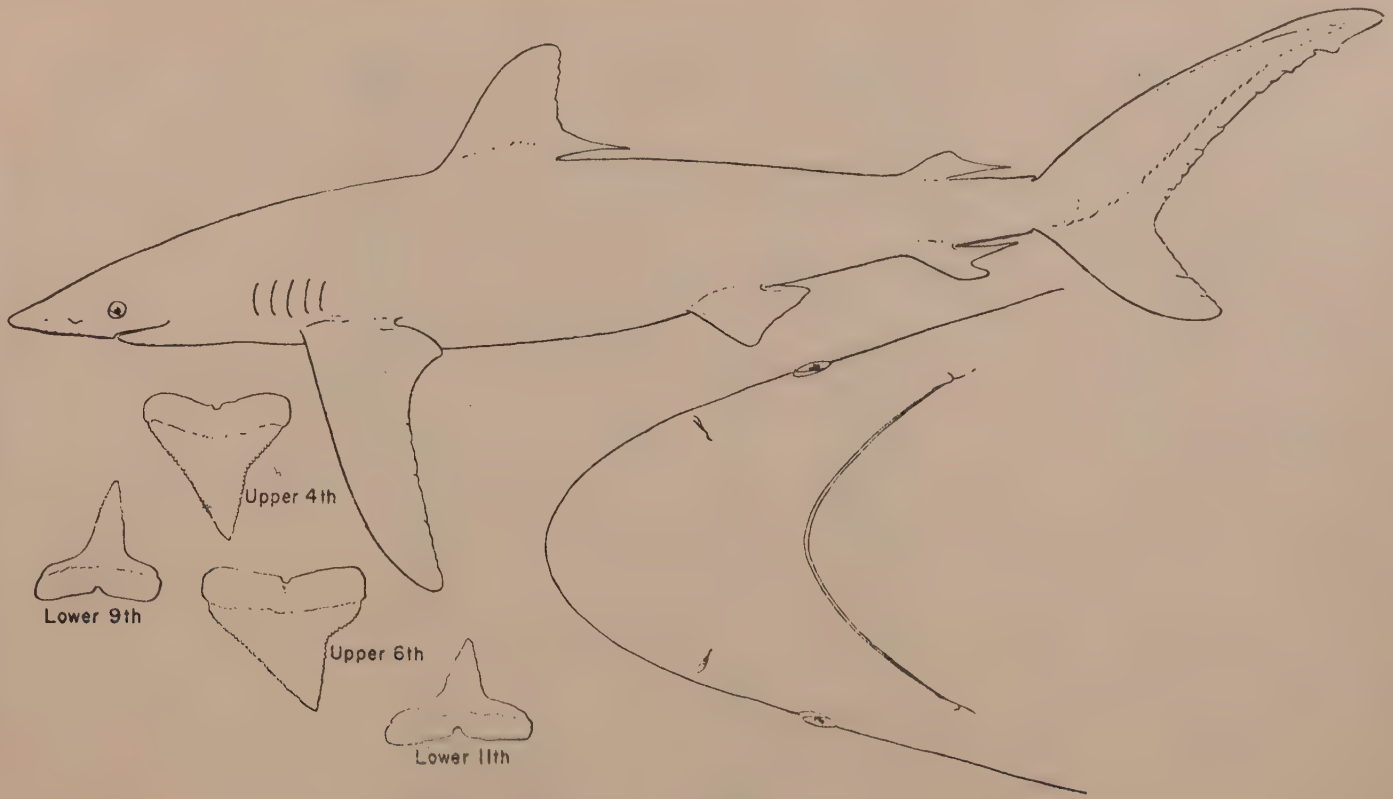


Fig. 22 Silky shark, Eulamia floridanus

Figure 23

Genus *Eulamia,* Requiem Sharks.

Figure 23. Eulamia falciformis

Description: This species falls among the division of the genus with a ridge along the back. Among the members of that group, it most nearly resembles *floridanus* in the very long free rear tips of its second dorsal and anal fins and in its teeth. However, it has a much shorter pectoral (only 2/3 as long as the head) that is, distance from snout to fifth gill opening, a larger eye (its diameter about 1/3 as long as the distance between the nostrils), and a more broadly rounded snout.

Color: Dark grey above, whitish below.

Size: Probably does not mature until about 6 feet long. It grows to about 10 feet.

Habits: It has no common name so far as we know. It is chiefly an offshore species, caught off southern Florida on set lines along the reefs in about 60 feet of water. Nothing further is known of its habits.

Range: A tropical-subtropical species, known from both sides of the Atlantic. It is evidently widespread in the Caribbean region and has been definitely reported from Trinidad, Haiti, Puerto Rico, Cuba, Bermuda, and from southern Florida where it is common outside the reefs.

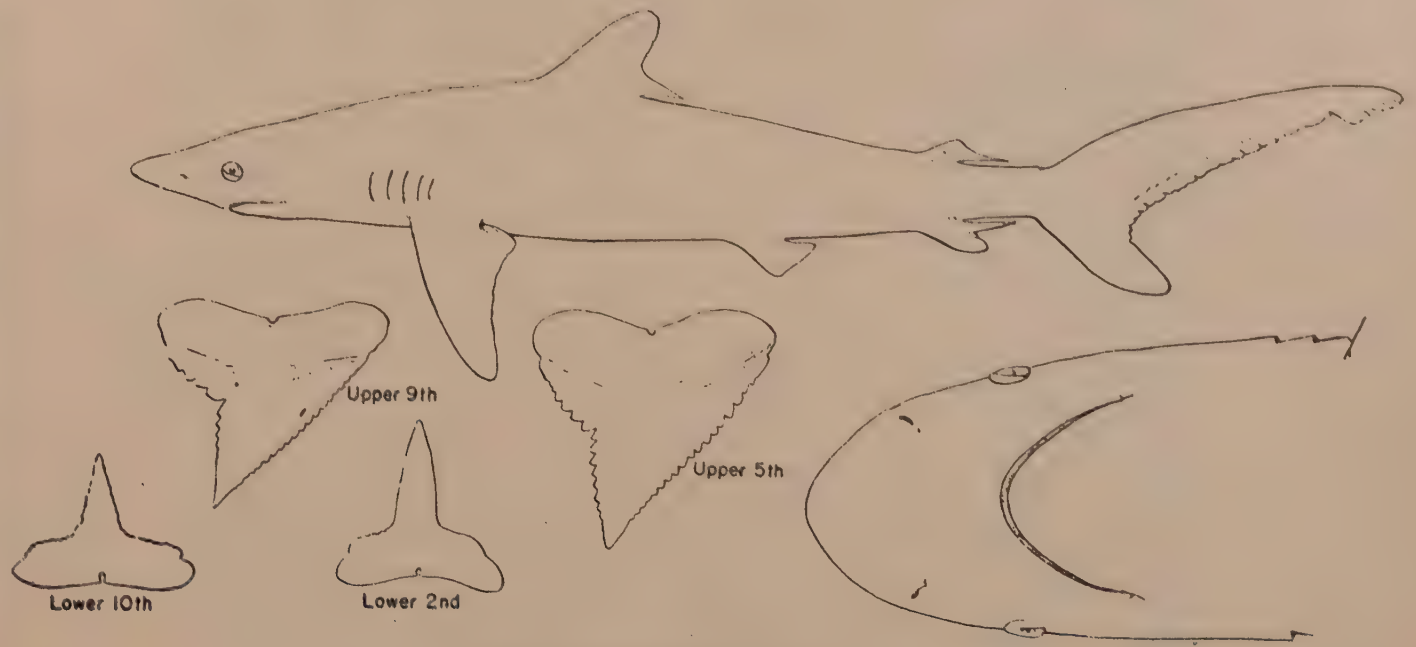


Fig. 23 Eulamia falciformis

Figure 24

Genus *Eulamia,* Requiem Sharks.

Figure 24. **Eulamia longimanus, White-Tipped Shark.**

Description: This species is set apart from all other Atlantic members of its genus by the facts (in combination) that the rear tip of its anal reaches very nearly to the origin of its lower caudal lobe (this, though apparently minor, is perhaps its most distinctive single character), and that its snout is both broadly rounded and extremely short in front of its nostrils. *leucas,* Figure 27, alone rivals it in this respect). Its first dorsal fin, also, is much more broadly rounded than in any other local Eulamia except for *falciformis.* There is no danger of confusing it with this species since its pectorals are so much longer. (Compare Figure 24 with Figure 23).

Color: Varying from light gray or pale brown to slaty blue above; yellowish or dirty white below; the tips of the dorsals greyish or pure white. In embryos, however, the tips of the fins are more or less sooty or even black.

Size: Born at a length of a little more than 2 feet, maturity appears not to be reached until at a length of about 6 feet. The maximum size is 12 to 13 feet or perhaps even longer.

Habits: This appears to be strictly an offshore species seldom encountered near land unless over deep water. It feeds on fish, of which it is said to destroy great numbers, and it is so well armed that it would not be astonishing to find it preying on large fish as well as small, or on sea turtles. It has been accused, vaguely, of being a man-eater.

Range: Tropical and subtropical Atlantic, including the Mediterranean. Off the American coast its nominal range is from the coasts of Uruguay and southern Brazil, to the Bahamas, and from there northward in the Gulf Stream perhaps to the offing of southern New England. Because it is seldom seen inshore and because it has often been confused with other species, knowledge of its distribution in an area is scant. Published records of localities where it has been seen and word of mouth reports of "white-tipped sharks" as often seen, added to the fact that twenty-eight of them have been in sight at one time, proves that it is not only widespread among the West Indies and in the Caribbean, but common there.

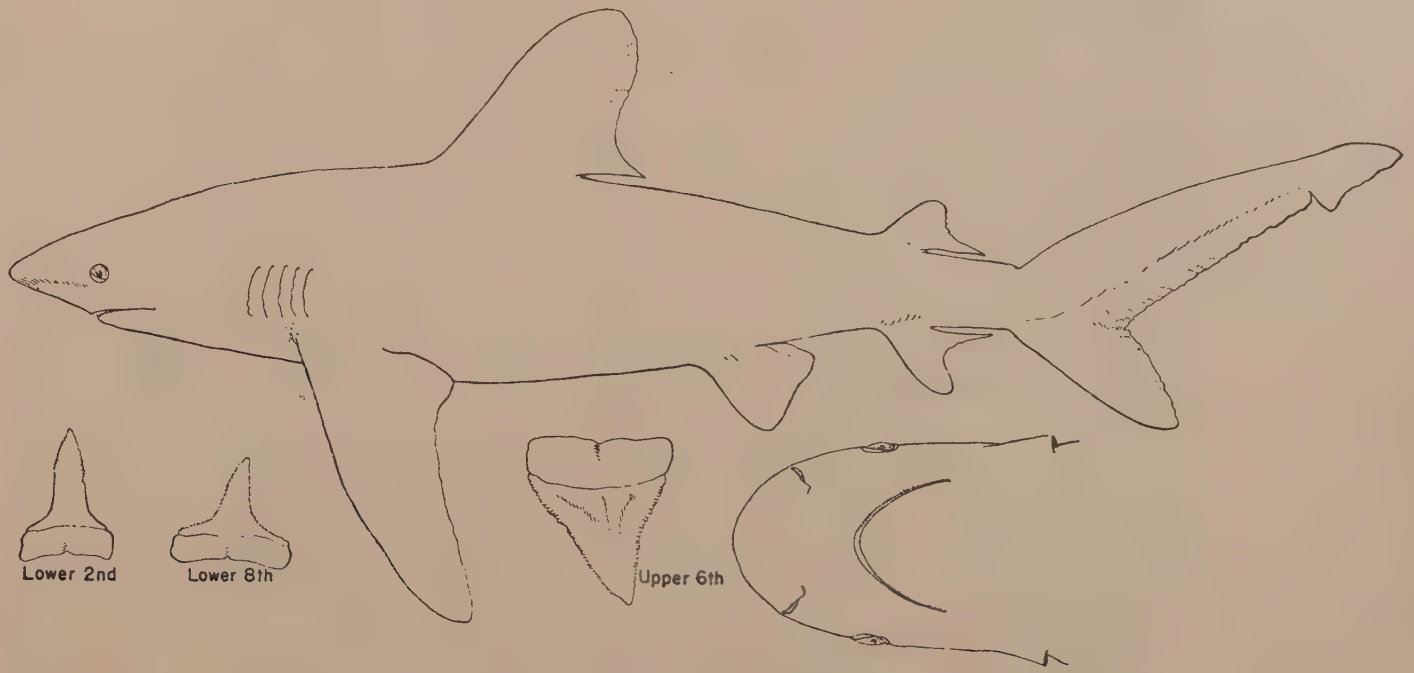


Fig. 24 White-tipped shark, Eulamia longimanus

Figure 25

Genus *Eulamia,* Requiem Sharks.

Figure 25. Eulamia obscurus, Dusky Shark.

Description: Among ridge-backed members of this genus (of which it is one), *obscurus* most resembles *milberti* (Figure 26). In fact, it has often been confused with it. It is easily separable from it, however, by the fact that the vertical height of its first dorsal fin is considerably less than the distance from the eye to the first gill opening, and also that it originates farther toward the rear. It differs from the other ridge-back species *falciformis* and *floridanus* in the shapes of its second dorsal and anal fins as well as of its teeth; from *longimanus* in the facts that the tip of its first dorsal fin is not broadly rounded and that the tip of its anal does not fall near the point of origin of the lower lobe of the caudal.

Color: Bluish or brownish or leaden gray above; greyish or pure white below, except that the lower surfaces of the pelvics are grayish and sooty toward their tips.

Size: Born at a length of about 34 to 40 inches, it grows commonly to a length of 10 to 12 feet and is reputed to reach 14 feet though perhaps not on any positive grounds.

Habits: About all that is known of its habits is that it is taken both close inshore as well as farther out at sea and that it is a fish eater. In Floridian waters, groupers and various other reef fishes, as well as portions of other sharks, have been found in its stomach. Present indications are that it produces young throughout its geographic range and over a long season.

Range: Both sides of the Atlantic, in tropical and warm temperate waters. From southern Massachusetts to southern Brazil off the American coast. *Obscurus* has often been confused with other species, but it is certainly common throughout the year off the east coast of Florida where large ones are often taken on set lines. It is probable, too, that it occurs generally throughout the West Indies and Caribbean, for it has been reported from the Bahamas, from Trinidad, from British Guiana, as well as from Brazil. To the northward, young ones often range as far as southern New England in summer.

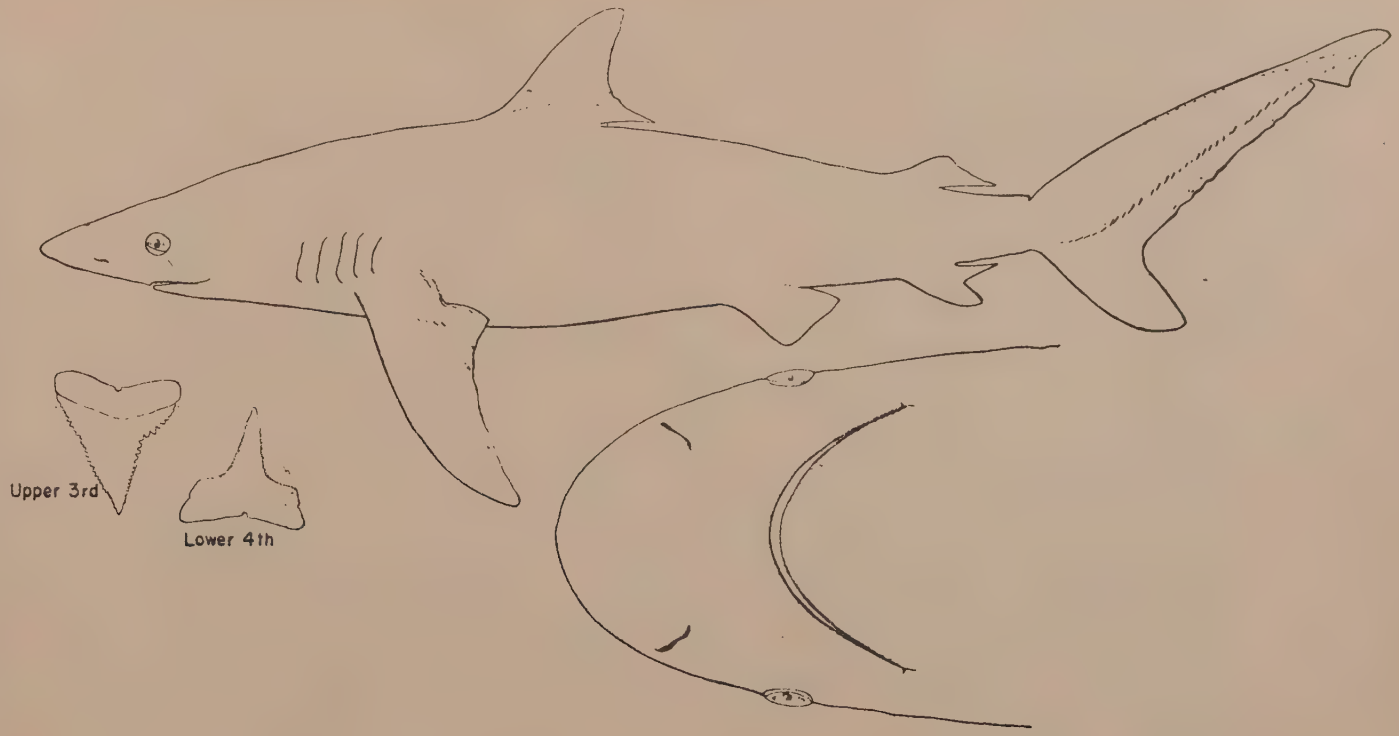


Fig 25 Dusky shark, Eulamia obscurus

Figure 26

Genus *Eulamia*, Requiem Sharks.

Figure 26. Eulamia milberti, Brown Shark, Sand Bar Shark.

Description: *E. milberti* is one of the ridge-backed members of the genus. It is easily recognizable among other species with this feature by the large size of the first dorsal fin (its vertical height is about as great as the distance from the eye to the second-third gill opening) and by its position far forward with its origin over the center of the pectoral, combined with the fact that the free rear margin of its second dorsal is only about as long as the base of that fin. The scales on the sides are also much more loosely spaced than in other local members of the genus.

Color: Varying from slate gray to brownish gray or brown above, perhaps depending on the color of the surroundings; a paler tint of the same hue or white below. The fins have no conspicuous markings.

Size: Usually about 22 inches long at birth, it matures at about 6 feet; occasionally growing to 8 feet or so. Weights are from about 100 pounds at 6 feet to about 200 pounds at 7 feet 8 inches.

Habits: An inshore species, most often seen at river mouths, in shallow bays and similar places. It is often taken in pound nets or harpooned, but it seldom shows at the surface. It feeds chiefly on small fishes—including skates and dog fish, a wide variety of which have been found in its stomach—also on crabs, bivalves, mollusks and octopuses to some extent. Seemingly its young are produced chiefly in the northern parts of its range in summer. So far as it is known, it is wholly harmless.

Range: In the western Atlantic from southern Brazil to New England. It is still an open question whether repeated reports of its presence in the Mediterranean and from neighboring parts of the eastern Atlantic actually refer to the same species. This is perhaps the most numerous of the sharks that are caught in southern Florida in winter. It may occur generally in the Caribbean also at that season, for it has been recorded from Yucatan and from the coast of Nicaragua. In summer, on the other hand, so many visit the coast of the United States between New Jersey and Cape Cod, that there is record of fourteen of them harpooned by one single fishing boat near New York in one day. But it is not known whether the entire stock shares in this migration, or whether some remain in more southern waters throughout the year.

Fig. 26 Brown shark, Eulamia milberti

Figure 27

Genus *Carcharhinus* Requiem Sharks

Figure 27. **Eulamia leucas, Bull Shark, Cub Shark.**

Description: *E. leucas* differs from all other Atlantic members of its family, except for *Negaprion brevirostris* (Figure 41), and *Galeocerdo tigrinus* (Figure 26), in its extremely short and very broadly rounded snout, combined with the fact that there is no ridge along its back. The fact that its second dorsal is much smaller than its first dorsal is however enough to mark it off at a glance from the first of these. A relatively shorter and broader pectoral, the shape of the first dorsal fin (compare Figure 27 with Figure 26), and the fact that the rear tip of its anal fin is far from the point of origin of the lower lobe of the caudal, separate it from the adults of the *E. longimanus* that may lack the mid-dorsal ridge.

Color: Grey above, varying from pale to dark apparently according to the color of the bottom over which it is living; white below. Adults do not have any conspicuous fin markings.

Size: Matures at a length of about 7 feet. This species grows to 10 feet or a little more. Reported weights are 250 to 375 pounds at 8 to 9½ feet and 600 pounds at 10 feet.

Habits: A heavy, slow swimming species, most common inshore in shoal water; often caught around docks and at the entrances to passages between islands and keys; also often running up rivers even into fresh water, and represented by a land-locked form (*E. nicaraguensis*) in Lake Nicaragua. It feeds indiscriminately on all sorts of fish, large and small, including sting rays, the spines of which are sometimes found embedded in its jaws. It attacks smaller sharks and sometimes porpoises which it finds entangled in nets. It is a notorious scavenger and it bites readily on any large bait of fish or meat. Seemingly its young are born in late winter and early spring.

Range: Western Atlantic, from southern Brazil to North Carolina, and occasionally straying as far north as New York. It is not yet known whether it occurs in the eastern Atlantic. Present indications are that its center of abundance covers the West Indian-Caribbean region generally as far north as northern Florida and no doubt the southern part of the Gulf of Mexico as well. Throughout this area it is, in fact, one of the more numerous members of its genus, if not the most numerous. In the warmer parts of its range it is evident throughout the year.

Fig 27 Bell (1958), Paleozoic levels

Figure 28

Genus *Eulamia,* Requiem Sharks.

Figure 28. Eulamia limbatus, Small Black-Tipped Shark.

Description: Among the members of the genus in which the back does not have a ridge, *limbatus* resembles *maculipinnis* (Figure 29) in its conspicuously black-tipped fins and in the fact that its upper teeth toward the center of its mouth are slender, erect and symmetrical. It differs from *maculipinnis,* however, by its relatively larger eyes, by its shorter gill openings, by the fact that the free rear tip of its second dorsal is less slender, and by the fact that the edges of its lower and upper teeth are regular though finely serrate. (They are smooth in *maculipinnis).*

Color: Dark gray, dusky bronze or ashy blue above; white (pure or yellowish) below, with a band of the dark upper color extending backward along each side, and with the pale hue of the lower parts extending forward. In the adult, the pectorals are conspicuously tipped with black. In young specimens the dorsals, the anal and the lower lobe of the caudal are also tipped with black.

Size: Maturing at 4 to 5 feet, adults average about 5½ to 6½ feet. Few grow longer than 7 feet, with 8 feet about the maximum. Recorded weights are about 4 pounds at 28 inches, about 20 pounds at 4 feet, about 42 pounds at 5 feet, and 68 pounds at about 5½ feet.

Habits: Very active and swift, often seen in schools at the surface and frequently leaping clear of the water; encountered indifferently near shore and far out at sea. It feeds chiefly on the smaller kinds of schooling fishes but sometimes attacks sting rays, evidenced by the discovery of their spines embedded in its jaws. It appears that the young are born chiefly in late spring.

Range: Tropical and subtropical Atlantic from southern Brazil to North Carolina and straying occasionally as far as southern New England in the western side; also eastern tropical Pacific from lower California to Peru. One of the commoner sharks among the Bahamas, around southern Florida, and in the northern part of the Gulf of Mexico. It is undoubtedly equally widespread (and locally common) in the southern part of the Gulf, southward along the coast of Brazil, and throughout the Caribbean-West Indian region in general where it has been recorded from many localities.

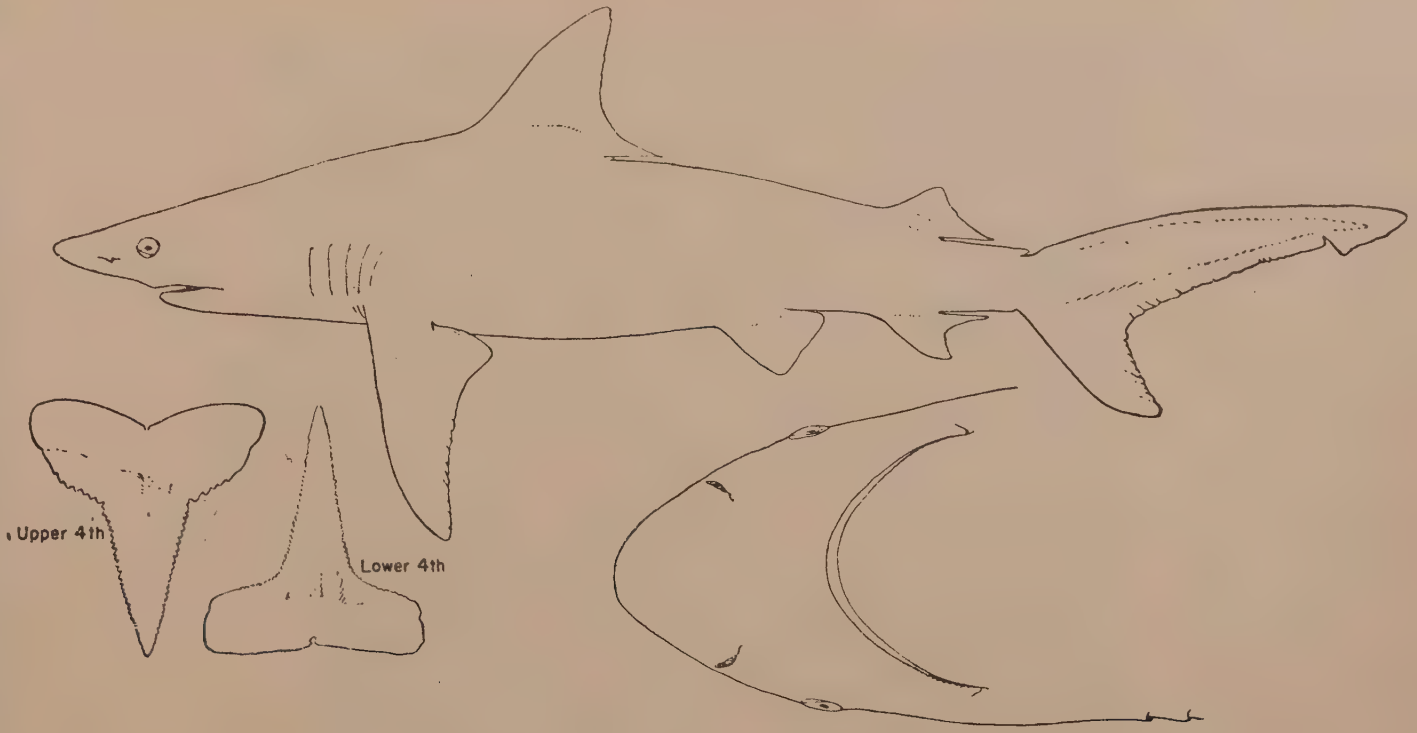


Fig. 28 Small black-tipped shark, Eulamia limbatus

Figure 29

Genus *Eulamia,* Requiem Sharks.

Figure 29. Eulamia maculipinnis, Great Black-Tipped Shark.

Description: Among local Eulamias that do not have a ridge down the middle of the back, this species most resembles *limbatus* in its general appearance, in its fins and teeth and in its color, especially in the fact that its fins are conspicuously tipped with black. It is separated from *limbatus,* however, by its smaller eyes but longer gill openings, also by the facts that the free rear tip of its second dorsal is noticeably more slender and that the edges of its lower teeth are perfectly smooth. (They are finely serrate in *limbatus).*

Color: Varying shades of gray above; white or whitish below, with a narrowing band of the darker shade of the upper parts extending rearward and above the band a forward extension of the pale shade of the lower parts. The second dorsal, the lower surfaces of pectorals and the lower lobe of caudal are conspicuously tipped with black.

Size: The few specimens so far measured have ranged from 5 feet 8 inches long to about 8 feet.

Habits: This shark has been seen in schools and leaping at the surface as *limbatus* does. Nothing more is known of its habits.

Range: Although first described more than three quarters of a century ago, this species has been so generally confused with *limbatus* that the published record affords very little confirmation as to its distribution. Actually it is common enough in waters off southern Florida for the local fishermen to be familiar with it. Since it is also known from Cuba and from Puerto Rico, it undoubtedly occurs generally throughout the Caribbean and among the West Indies. We have no confirmation, however, as to the percentage that it forms of the catches that are made.

Fig. 29 Great black-tipped shark, Eulamia maculipinnis

Figure 30

Family Hexanchidae, Six and Seven-Gilled Sharks. Six or seven gill openings; an anal fin but only one dorsal fin; upper and lower teeth noticeably unlike.

Genus *Heptranchias,* Seven-Gilled Sharks. Seven gill openings, otherwise much like *Hexanchus* (Figure 31).

Figure 30. Heptranchias perlo, Seven-Gilled Shark.

Description: Resembles the Six-Gilled Shark in general appearance, in relative sizes and locations of fins and in teeth (see description under Figure 31). It differs sharply from it, however, in having seven gill openings. Further differences are that its snout is narrow and tapering, that the far edge of its pectoral fin is noticeably concave and that its anal fin is much smaller than its dorsal.

Color: Gray, sometimes shaded with brown; only a little paler below than above. The pectorals and the lower margin of the caudal are bordered with white. The dorsal has two white spots and is black at the tip.

Size: Born at length of about 10 inches, it matures at 2 to 3 feet (males smaller than females) and grows to a maximum size of about 7 feet.

Habits: Little is known of its habits, except that it feeds on smaller fish and that it lives chiefly on the bottom or near it. It has been taken only in deep water in the Caribbean and off Portugal, but also in shoal water off West Africa.

Range: Both sides of the North Atlantic, Cape of Good Hope, Japan, and perhaps Australia. In the Caribbean region it has been recorded only off Matanzas, Cuba, where it is taken occasionally by the long-line fishery in deep water. We include it to facilitate identification, for it may probably prove widespead in the Caribbean in the deeper layers of water.

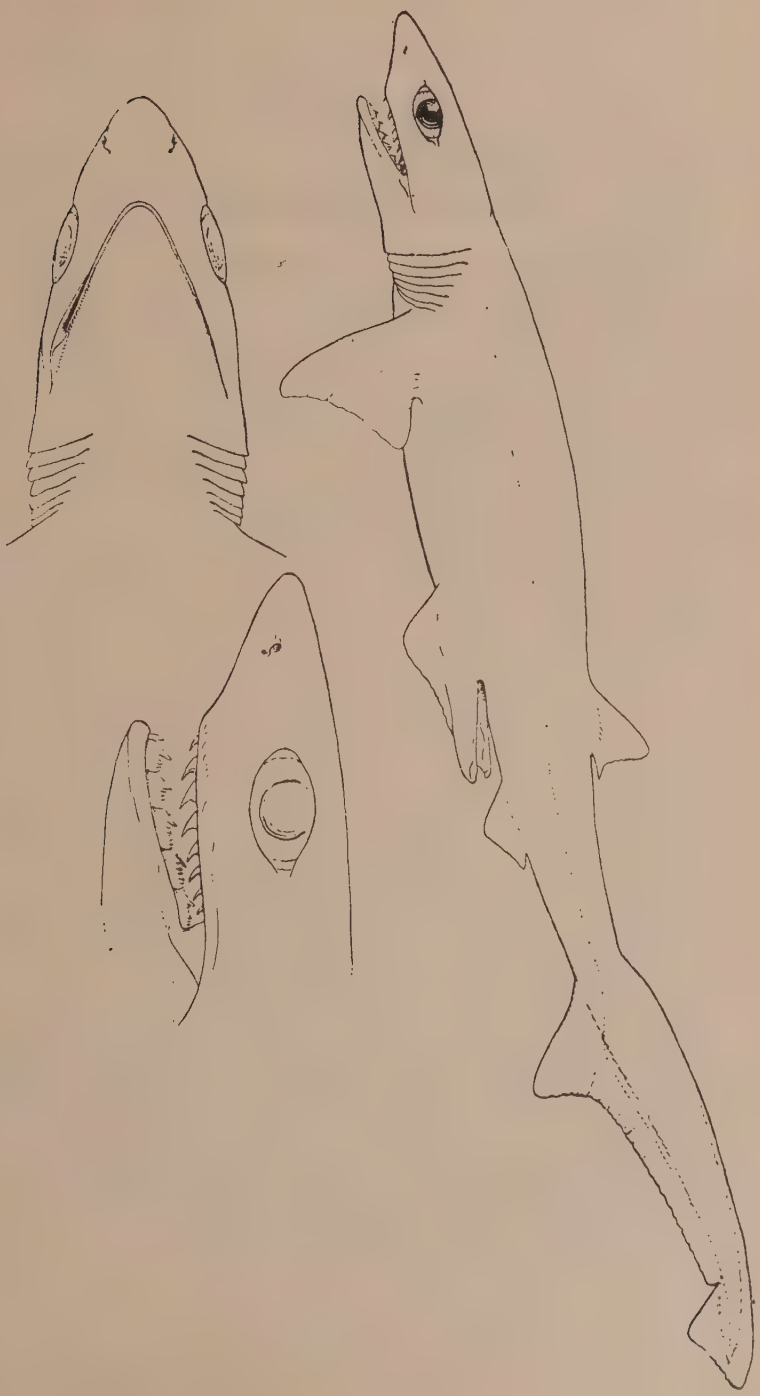


Fig. 30 Seven-gilled shark, Heptranchias perlo

Figure 31

Family Hexanchidae.

Genus *Hexanchus,* Six-Gilled Sharks; only six gill openings.

Figure 31. Hexanchus griseus, Six-Gilled Shark; Cow Shark, Mud Shark.

Description: Front part of trunk fairly thick; snout short and broadly rounded; eye large; mouth very large and extending along sides of head; upper teeth thorn-like with one to three short basal cusps on the outer side; the first five or six lower teeth much broader with seven to ten short cusps; the fourth to sixth lower teeth very low, rounded and without definite cusps; anal fin is similar to the dorsal in size and shape; the caudal does not have a definite lower lobe and its axis is raised only very little above the main axis of the body; the margins of the pectoral fins are nearly straight and their corners well rounded.

Color: Coffee-colored or very dark gray above; a paler shade of the same tint or whitish below. Some specimens have a pale streak along each side.

Size: This is one of the largest sharks. It is born at a length of 16 to 24 inches and matures at 6 to 6½ feet, often growing to 14 to 15 feet and occasionally even somewhat larger. A 7-foot specimen may be expected to weigh between 300 to 400 pounds; one of 9 feet, between 500 to 550 pounds; one of 13 feet, between 1,000 and 1,100 pounds; one of 15 feet about 1,300 pounds.

Habits: In West Indian waters this shark lives chiefly at depths greater than 75 fathoms and down to more than 400 fathoms. In more northern seas it often comes much closer to the surface. It feeds chiefly on fish—Dolphins, small Marlins and small Swordfish have been found in their stomachs off Cuba. It also feeds on crabs and shrimps. They sometimes bite chunks from other sharks that have been hooked. They bite readily from set lines. The breeding season is not known for the Caribbean area.

Range: Both sides of the North Atlantic, including the Mediterranean; also the Pacific coast of North America (Southern California to British Columbia), Chile, Japan, the West Indian ocean and South Africa. It is so far known only from the north coast of Cuba, but since specimens are now being taken frequently there on set lines, fishing at 100 to 400 fathoms, it is to be expected at similar depths throughout the region generally. It is not known to carry out any regular migrations.

Fig. 31 Six-gilled shark, Hexanchus griseus

Figure 32

Family Rhincodontidae, Whale Sharks. Only five gill openings; two dorsal fins and an anal fin; the second dorsal and the anal much smaller than the first dorsal; the caudal is about 1/4 of the total length of the shark and is crescent shaped, with its axis raised steeply above the general axis of the body. The mouth is at the tip of the snout; the nostril does not have a barbel; the inner edges of the gill arches are connected by a sponge-like mass of tissues which acts as a sieve, through which water is forced when the mouth is closed. In this way, minute organisms and small fishes are gathered to be swallowed. The structure is unique among sharks.

Genus *Rhincodon*, Whale Sharks. Characters as above.

Figure 32. Rhincodon typus, Whale Shark.

Description: Trunk rather stout with two prominent ridges along each side; head broadly rounded in front without any distinct snout; the mouth at the front tip of the head (this character is unique among West Indian sharks); nostril very close to mouth but not connected with it; eye very small; gill openings large but high up on the sides of the neck; the fifth gill opening over the origin of the pectoral fin; teeth similar in the two jaws, conical, very small, in 10 to 15 functional series and very numerous—an 18-foot specimen having a total of about 3,600 in each jaw and larger specimens still more. First dorsal fin overlaps pelvics; second dorsal only about 1/3 as large in area as first; lower rear edge of upper lobe of caudal is not notched near the tip (it is so notched in most other local sharks); lower lobe about 3/4 as long as upper; pelvics only about as large as second dorsal; and pectoral with noticeably concave distal margin.

Color: Upper parts dark grayish, reddish or greenish brown, conspicuously marked with round white or yellow spots and with a variable number of white or yellow cross stripes. Lower parts are plain whitish or yellow.

Size: The smallest specimen yet measured was 6 feet long, the largest about 45 feet. It is credibly reported to grow to a length of 60 feet or even more. The estimated weight of one of 38 feet was 26,594 pounds. The size at which sexual mating is reached is not known, nor is it yet known whether or not the eggs hatch within the mother before birth.

Habits: About all that is known of its habits is that it gathers in schools, that it often basks at the surface and that it is so little alert that one is rammed by a steamer from time to time. It feeds on small crustacea, but perhaps more often on schools of small fish such as anchovies. It obtains these by swimming open-mouthed and then driving water out through its branchial sieve thus separating the prey. Whale sharks have often been seen so employed at the surface, sometimes while vertical in the water.

Range: Tropical belts of all the great oceans. Reported from

many localities but perhaps most numerous off the west coast of Mexico and among the Philippines. Whale sharks are to be expected anywhere in our area for they have been seen repeatedly off Brazil, in various parts of the Caribbean and off the Gulf of Mexico, off Cuba, in southern Florida and in the Gulf Stream between Florida and the Bahamas. Occasional specimens have even been known to stray as far north as New York.

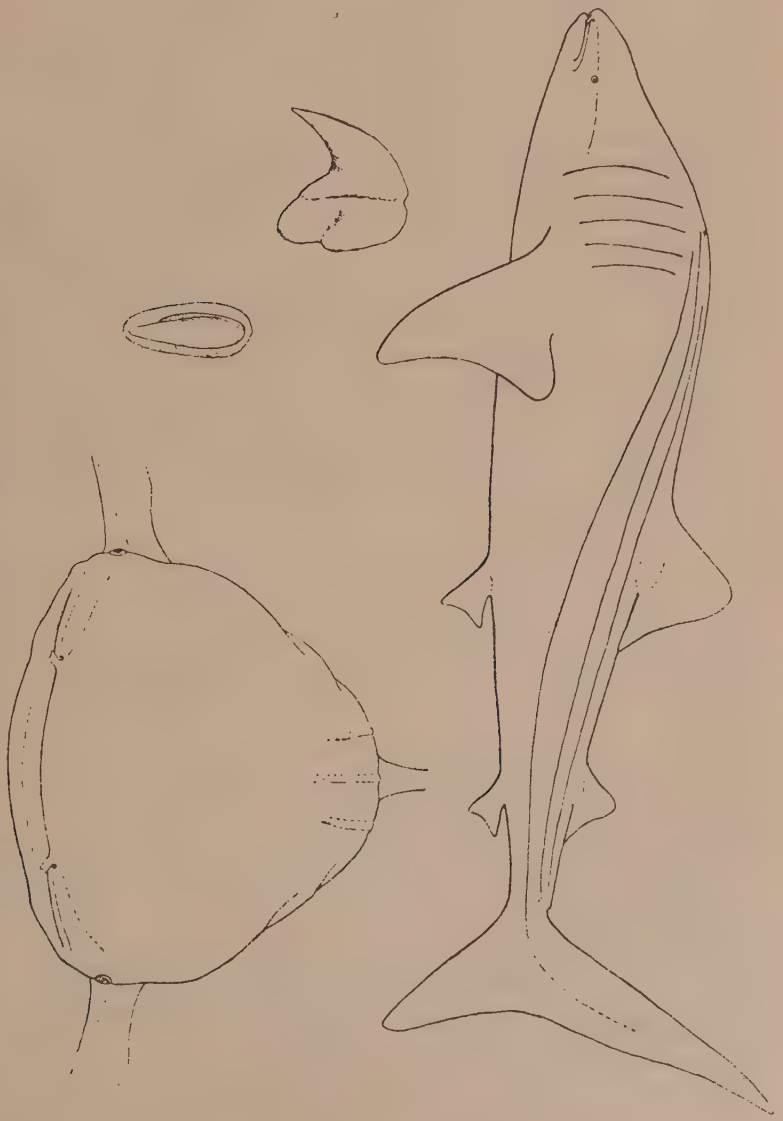


Fig. 32 Whale shark, Rhincodon typus

Figure 33

Family *Orectolobidae,* Nurse Sharks. Only five gill openings, the fourth and fifth (sometimes the third also) over the origin of the pectoral; caudal peduncle not flattened above and below; without longitudinal keels, either above or below; spiracle present; nostril connected with the mouth by a groove, its front margin with a prominent fleshy barbel. Two dorsal fins, the first over the pelvics; second dorsal fin not much smaller than first; caudal without a definite lower lobe, its axis raised but little above the main axis of the trunk; teeth small and numerous.

Genus *Ginglymostoma,* Nurse Sharks. No fleshy lobes on sides of head; the second dorsal originates anterior to the origin of the anal; the spiracle is very small.

Figure 33. Ginglymostoma cirratum, Nurse Shark.

Description: Trunk moderately stout; snout broadly rounded and noticeably short. The nasal barbel (the most distinctive feature) reaches back as far as the mouth; eyes very small; gill openings noticeably short, the fourth and fifth very close together over the origin of the pectoral; mouth transverse and nearly straight with very prominent labial furrows at the corners on both jaws; teeth 15 to 18 on each side of upper jaw and 14 to 16 each side below, similar in the two jaws, with high triangular central cusp, flanked on either side by 1 to 3 smaller ones; the first dorsal is over the pelvics, the second dorsal is nearly as large as the first and similar to it in shape; lower rear margin of the caudal is nearly straight; the anal a little smaller than the second dorsal; the pectoral broad and short with nearly straight distal edge and with rounded corners.

Color: Yellowish or grayish brown above; a paler shade of the same hue below. Small ones are variously marked with small dark spots and cross-bars, but adults often lose these markings.

Size: No greater than one foot, it matures at 5 feet or even less, often growing, however, to 11 to 12 feet. It occasionally grows as large as 14 feet. An 8½-foot specimen will weigh 330 to 370 pounds.

Habits: Found chiefly inshore and often in water only two or three feet deep, as in channels among the Mangrove Keys and on sand flats, bars, etc. It is sluggish and easily approached. It feeds chiefly on invertebrates, such as shrimps, crabs, spiny lobsters; also on sea urchins or squids and on small fish. It bites greedily on almost any bait. They come into very shallow water to mate, and pairs, so engaged, are often seen.

Range: Both sides of the tropical and subtropical Atlantic. This is one of the more common sharks throughout the West Indian-Caribbean region and has been reported from many localities from southern Brazil to southern Florida. In summer it ranges northward both to the northern shores of the Gulf of Mexico and to North Carolina, occasionally even farther along the east coast of the United States.

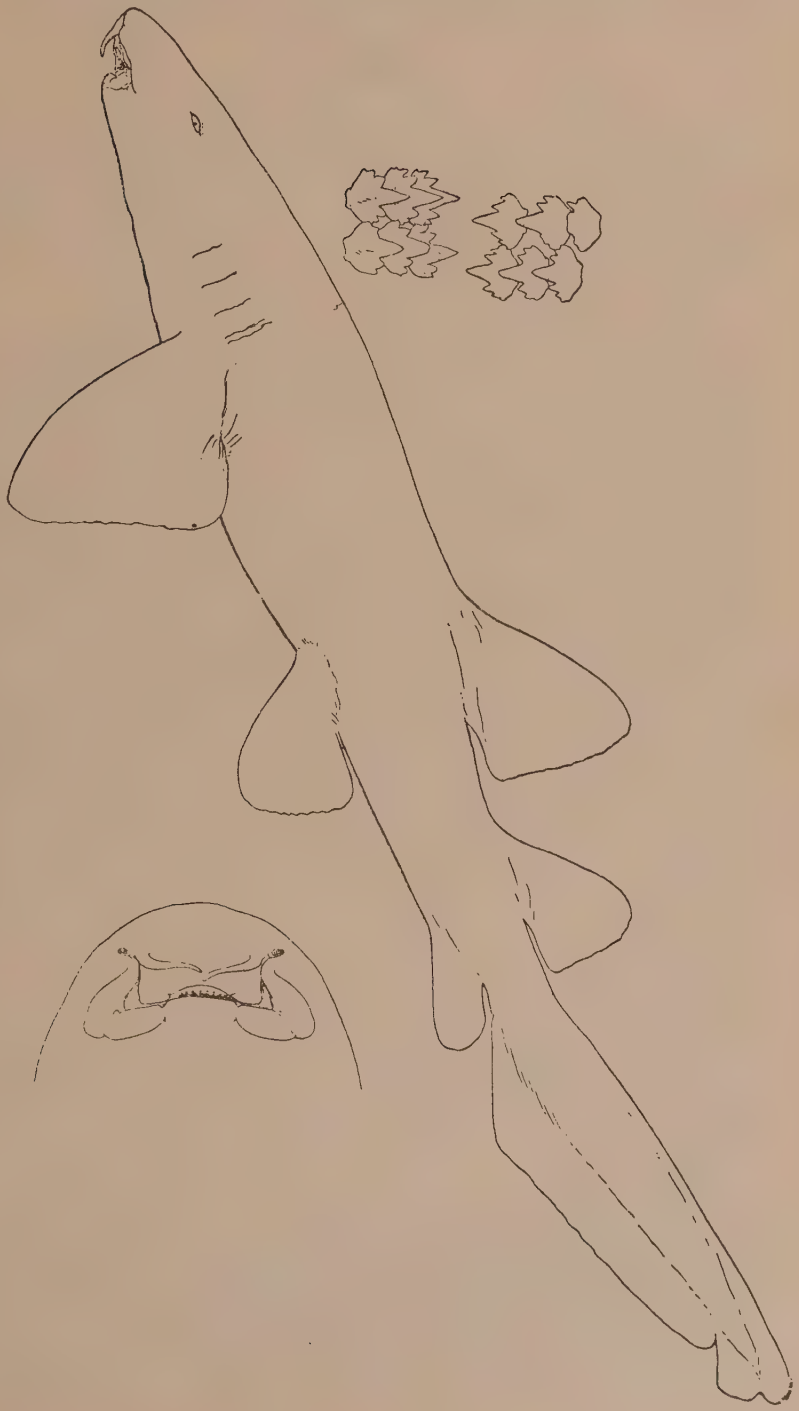


Fig. 33 Nurse shark, Ginglymostoma cirratum

Figure 34

Family Carcharhidae, Sand Sharks. Only five gill openings, all of them in front of the origin of the pectoral fins; with a spiracle, an anal fin and two dorsal fins, the base of the first dorsal fin wholly in front of the pelvics; caudal fin less than 1/3 of the total length of the shark; its axis raised but little above the general axis of the trunk; teeth slender and fang-like; eyes without nictitating ("winking") membrane.

Genus *Carcharias*, Sand Sharks. Characters as above.

Figure 34. Carcharias taurus, Sand Tiger, Sand Shark.

Description: Trunk moderately slender; caudal peduncle without side ridges, with a pit in front of the caudal above but none below; snout tapering, with narrowly rounded tip and about 2/3 as long as the mouth is broad; spiracles minute on a level with eyes about opposite corners of mouth; a well-marked labial furrow on lower jaw near corner of mouth and one less apparent on upper. About 22 to 24 teeth on each side of upper jaw and 20 to 23 on each side of lower jaw; upper and lower alike, on broadly divided bases, slender, awl-like, with or without 1 or 2 small basal denticles on either side; fourth upper tooth much smaller than the fifth or sixth, and separated from the fifth by a broad space; the outermost 12 or 13 teeth in each jaw very small and close together. Base of first dorsal fin in females a little in front of pelvic fins; second dorsal fin about as large as first dorsal fin and similar to it in shape; caudal with a well-defined lower lobe which is about 1/3 as long as upper lobe; anal a little larger than second dorsal; pectorals with nearly straight distal margins and with rounded corners.

Color: Light grayish brown above; grayish white below; the sides variously marked with small yellowish brown or yellow spots, round or oval.

Size: Matures at a length of about 7 feet and grows commonly to 8 to 10 feet.

Habits: Chiefly on or close to bottom in shallow inshore waters; caught mostly in one to six fathoms or even shallower. Very voracious, feeding on wide variety of whatever smaller fishes are locally available, also on squid, crabs and lobsters but not on large prey (so far as is yet known). Probably its young are born chiefly in the northern part of its range, but little is known of its breeding habits.

Range: Both sides of North Atlantic with close allies in Argentine waters and in the Indo-Pacific. While not definitely recorded for the Caribbean, this shark is to be expected throughout the region for it is plentiful; also southern Brazil (Rio de Janeiro to Rio Grande do Sul) on the one hand and the east coast of Florida on the other, as well as northward all along the east coast of the United States as far as Cape Cod during the summer. In Florida it is taken at all seasons; northward, however, it occurs only as a summer visitor.

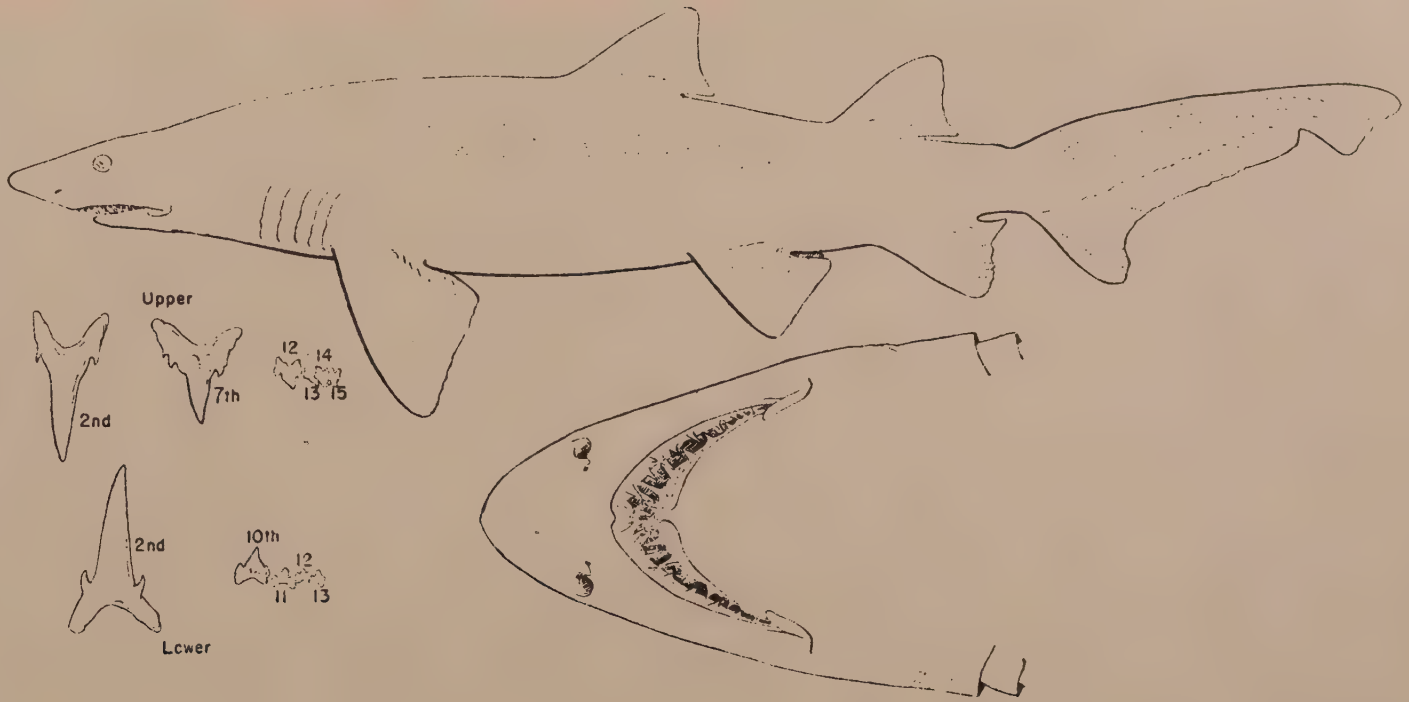


Fig. 34 Sand shark, Carcharias taurus

Figure 35

Family Isuridae, Mackerel and Man-Eater Sharks. Only 5 gill openings, the lower end of the fifth in front of the origin of the pectoral; 2 dorsal fins and an anal fin; the first dorsal fin originates far in front of the pelvics; caudal peduncle with a prominent longitudinal ridge or keel on each side; the second dorsal and anal fins much smaller than the first dorsal; the upper margin of the caudal not over 1/3 of the total length but its axis raised steeply from the general axis of the trunk and its lower lobe more than 1/2 as long as its upper.

Genus *Isurus,* Mackerel Sharks (so named from the shape of their caudal fins); Makos. Teeth slender, awl-like, with smooth edges.

Figure 35: Isurus oxyrhincus, Mako, Sharp-nosed Mackerel Shark.

Description: Trunk tapering both toward snout and toward tail; caudal peduncle much flattened above and below but broadly expanded sidewise as a prominent sharp-edged keel on each side, with a deep transverse furrow above and below close in front of the origin of the caudal; snout conical and below close in front of a minute pore or slit; gill openings noticeably large, the first to the fourth about as long as the snout (in front of mouth); teeth similar in the two jaws, 12 or 13 on a side, both above and below, their edges perfectly smooth, the first two in each jaw the largest and the most slender; flexuous in outline; the third upper tooth much smaller than the second or fourth; the teeth along the sides of the jaws more triangular, as illustrated. First dorsal fin high and triangular; second dorsal fin only about 1/7 to 1/8 as long as the first dorsal; caudal crescent in outline, its lower lobe about 3/4 as long as the upper; anal similar to second dorsal in size and shape. Pectoral noticeably long and narrow (a little less than 1/2 as broad as long), with rounded tip and weakly concave distal margin.

Color: Deep blue above in life (often appearing cobalt or ultramarine-blue in the water), but soon fading to a dirty slate-gray; snow white below.

Size: Matures at a length of about 6 feet; it grows to a maximum length of about 12 feet; recorded weights are 135 lbs. at about 6 feet, about 300 lbs. at 8 feet and about 1,000 lbs. at 10 feet, 6 inches; largest West Indian specimen so far taken on rod and reel weighed 786 lbs.

Habits: One of the most active and swift swimming sharks, famous for its habit of leaping clear of the water; a favorite with sport-anglers; often seen on sunny days with the dorsal fin and the tip of the caudal fins cutting the surface of the sea. Found both near land and far out at sea, preying on schools of the smaller fishes and on larger prey, even swordfish. The flesh of this and of other members of its family is perhaps the most palatable of any sharks.

Range: Both sides of the warmer latitudes of the Atlantic, north and south; replaced by a close relative in the Pacific. It is plentiful in the Gulf Stream, along the western slope of the Bahamas and is reported from Cuba, the Gulf of Mexico and southern Brazil. No doubt it occurs generally throughout the West Indian-Caribbean region and around southern Florida. Northward it ranges in summer as far as Massachusetts, southward to northern Argentina.

Fig. 35 Mako, Isurus oxyrhincus

Figure 36

Family Insuridae, Mackerel and Man Eater Sharks.

Genus *Carcharodon*, Man Eater. Teeth triangular, blade-like, with regularly serrate edges.

Figure 36: Carcharodon carcharias, Man-Eater.

Description: Trunk stouter than that of the Mako, but tapering similarly rearward, with the caudal peduncle flattened above and below and expanded widely sidewise as sharp-edged keels; also with a deep transverse furrow above and below close to the origin of the caudal fin. Snout conical, but relatively shorter and less tapering than in the Mako (often distorted, however, when heavy specimens are dragged up the beach by the upper jaw); spiracle pore-like or lacking; the longest gill opening between 1-1/2 and 2 times as long as the snout (in front of mouth). Mouth more broadly rounded than in the Mako. Teeth (its most distinctive feature), 12 on each side of upper jaw and 11 or 12 in lower, with coarsely serrate edges; the uppers triangular, about as broad as high, with nearly straight edges; lowers narrower, their margins more concave; one (at most two) series functional; the first dorsal nearly an equilateral triangle, with narrow tip; second dorsal only about 1/5 to 1/6 as long and as high as first; caudal crescent, its lower lobe about 4/5 as long as the upper; anal similar to second dorsal, its origin close behind the base of the latter; pectorals noticeably large, nearly 1/2 as broad as long, with rounded tip and strongly concave distal margin.

Color: Specimens seen have been slate gray or almost black above, dirty white below, with a prominent black spot on the axils (armpits) of the pectorals. The tips of the pectorals are also more or less spotted with black on the lower surface. Large ones have been described as much paler or even leaden white.

Size: One of the largest of sharks, apparently not maturing until 13 to 14 feet long, often growing to 16 to 20 feet and, at least occasionally, to 30 to 36 feet. The largest West Indian specimen (Cuban) positively measured was 21 feet. One of 8 feet may be expected to weigh about 600 pounds, increasing to 900 to 1,000 pounds at 9 to 10 feet, to about 1,300 pounds at 13 feet, with a recorded weight of 7,000 pounds at 21 feet.

Habits: A strong active shark of the high seas, though it does not have the leaping habit of the Mako. Doubtless it is the most voracious of fishes, regularly capturing prey as large as sea turtles, other sharks, seals, and so forth. It also feeds on a wide variety of smaller fishes and on squids. On occasion, also, it is a proverbial scavenger, and it is one of the few species against which the charge of unprovoked attack on small boats as well as on swimmers is amply proven. It has long borne the reputation of a "man-eater." Its flesh is palatable and as salable as that of the Mackerel Sharks.

Range: Widespread in the warmer latitudes of all oceans both offshore and inshore, but fortunately not plentiful anywhere. Long

reputed to be widespread throughout the West Indian-Caribbean region, one is to be expected anywhere there off the open coast at any time, though few such events have been recorded. To the north, a few specimens have been taken off the Atlantic coast of the United States as far as Maine and occasionally even Nova Scotia and the Banks south of Newfoundland. It is known as far south as southern Brazil.

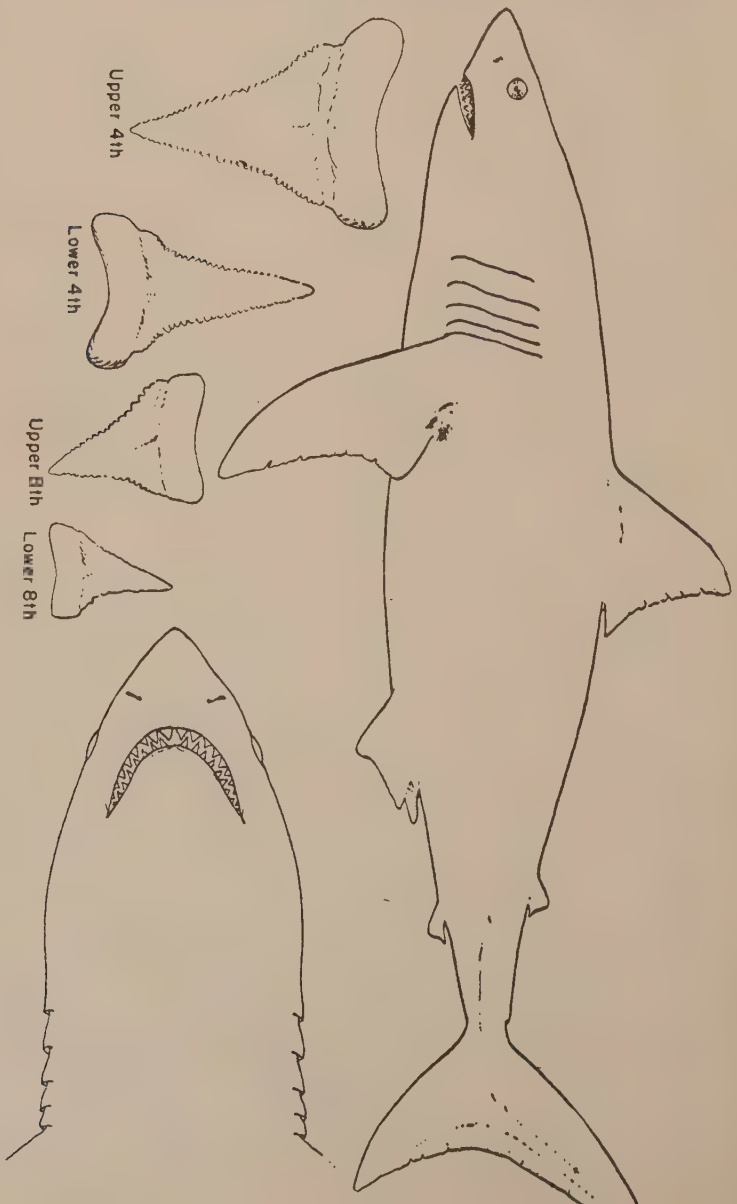


Fig. 36 Man eater, Carcharodon carcharias

Figure 37

Family Alopiidae, Threshers. Only five gill openings, the lower ends of the fourth and fifth over the origin of the pectoral fin; caudal peduncle not expanded sidewise with lateral keels; two dorsal fins and an anal fin; base of the first dorsal fin does not overlap the pelvics; second dorsal fin much smaller than first; caudal fin about as long as the trunk with a definitely outlined lower lobe; its axis raised only a little above the main axis of the trunk; eye without nictitating membrane; spiracles present. Teeth blade-like with one cusp.

Genus *Alopias,* Threshers. Characters as above.

Figure 37: Alopias vulpinus, Common Thresher.

Description: Trunk rather stout; caudal peduncle noticeably flattened sidewise without lateral keels but with a well-marked pit above though there is none below; snout short and broadly egg-shaped; gill openings noticeably short, the longest only a little longer than the diameter of the eye; mouth broadly rounded; teeth about 20 on each side in upper jaw and 21 in lower, similar in the two jaws with single cusp, triangular, but with concave outer and convex inner margins and increasingly oblique toward the corners of the mouth; the third upper tooth (counted from the center of the mouth) only about 1/3 as large as those on either side of it. First dorsal fin with rounded tip, its rear tip far in front of the origin of the pelvics; second dorsal only about 1/8 as long as first; caudal (its most striking feature) occupying approximately 1/2 or more of the total length of the shark, its upper lobe narrow and scythe-shaped, its lower lobe only about 1/8 to 1/9 as long as the upper; anal similar to second dorsal in size and shape; pectoral noticeably large, being as long as or even longer than the distance from its origin to the tip of the snout, about 1/2 as broad as long, with rounded tip, deeply concave distal margin and noticeably wide base.

Color: Back and upper sides varying from bluish or slaty gray to almost black, shading to white below, but with the lower surface of the snout and of the pectorals sometimes as dark as the back. The belly is sometimes more or less mottled with gray.

Size: Born as small as 4 to 5 feet, but probably does not mature until about 14 feet long (including the tail). It commonly grows to 16 feet and occasionally to 20 feet. Recorded weight from 300 to 320 pounds at 10 feet to about 500 pounds at 14 to 15 feet, with a maximum of perhaps 1,000 pounds.

Habits: An oceanic species although specimens and especially small ones are often encountered near shore; feeding chiefly on the smaller schooling fishes of whatever kinds are locally available—Bonito, for example, in tropical American waters and also on squid. Well known for its habit of crowding its prey together by circling the school and lashing the water with its whip-like tail.

Range: Warm, temperate and subtropical latitudes on both sides

of the Atlantic, Pacific and Indian Oceans. The Thresher, it appears, is not common in the West Indian-Caribbean region where it has been positively reported only off Havana. A few specimens, however, are to be expected anywhere there, for it is known from Brazil on the one hand, from the northern side of the Gulf of Mexico and from southern Florida (where it appears not to be uncommon) on the other. It is included here because of its bizarre appearance and because so often mentioned in the accounts of sharks in general. It is more numerous to the northward, frequently seen and caught in summer off the United States coast as far as Cape Cod, very occasionally as far as Nova Scotia, and even as a stray to the Gulf of St. Lawrence during the warm months.

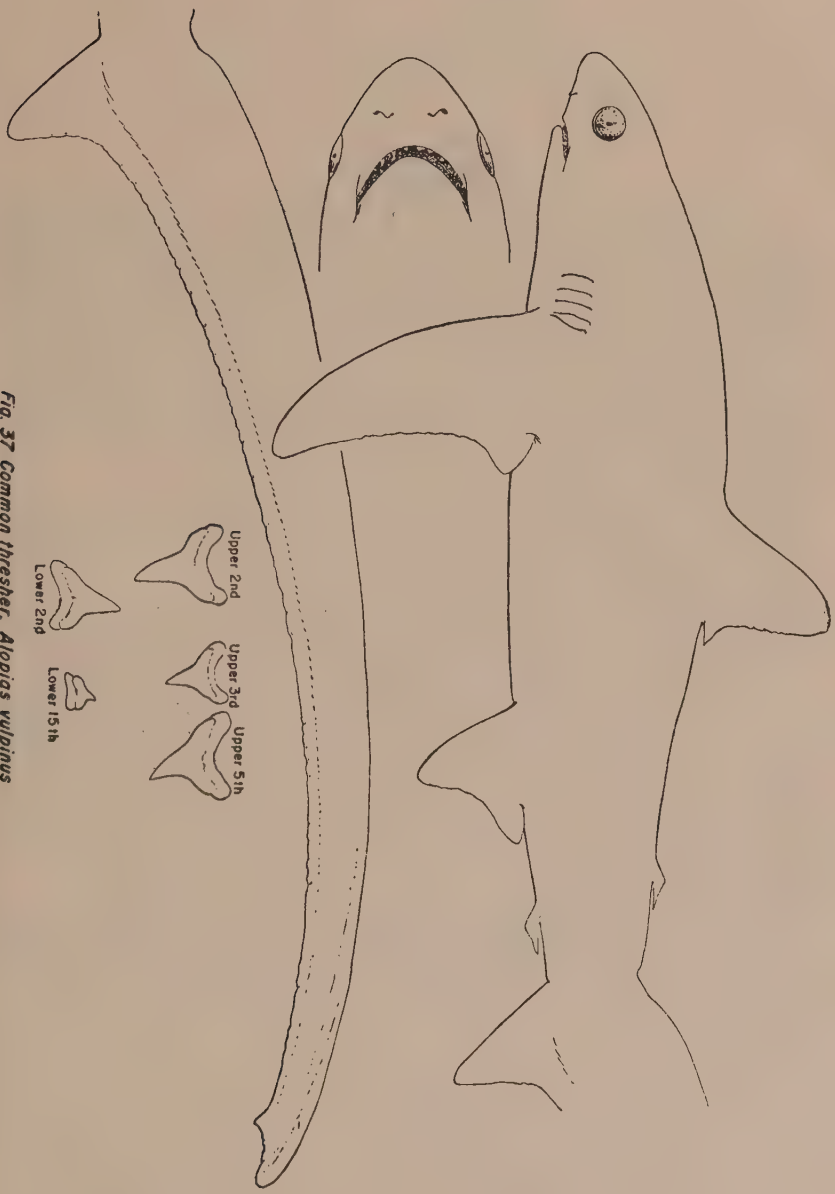


Fig. 37 Common thresher, Alopias vulpinus

Figure 38

Family Triakidae, Smooth Dog Fishes. Only five gill openings; two dorsal fins and an anal; the base of the first dorsal wholly in front of the pelvics; caudal less than 1/4 of the total length of the shark, its axis only a little raised; with or without a small lower lobe; lower ridges along the sides; the fourth or fifth gill opening over the origin of the pectoral; the nostril with or without a barbel; the eye does not have a nictitating ("winking") membrane inside the lower lid. Teeth small, several series in service simultaneously, either low and rounded or with 3 to 4 distinct cusps.

Genus *Mustelus,* Smooth Dog Fishes. The nostril is not connected with mouth and does not bear a barbel; the teeth are low, rounded and without definite cusps.

Figure 38. Mustelus norrisi, Florida Dog Fish.

Description: This very closely resembles Figure 39, but it is easily distinguished from it by the facts that the mid-point of the base of its first dorsal fin is considerably nearer to the origin of its pelvics than to the axil (armpit) of its pectoral (almost the same distance from these two points in the *M. canis)* and that the lower lobe of its caudal is sharp pointed and directed rearward (rounded in *M. canis).*

Color: Gray above; paler or dirty white below; without any conspicuous markings.

Size: Matures at 2 to 3 feet; maximum size not known.

Habits: Nothing known.

Range: While it is known possibly only from southern Florida, it is to be expected throughout the West Indian-Caribbean region. Hence it is included here as an aid to identification.

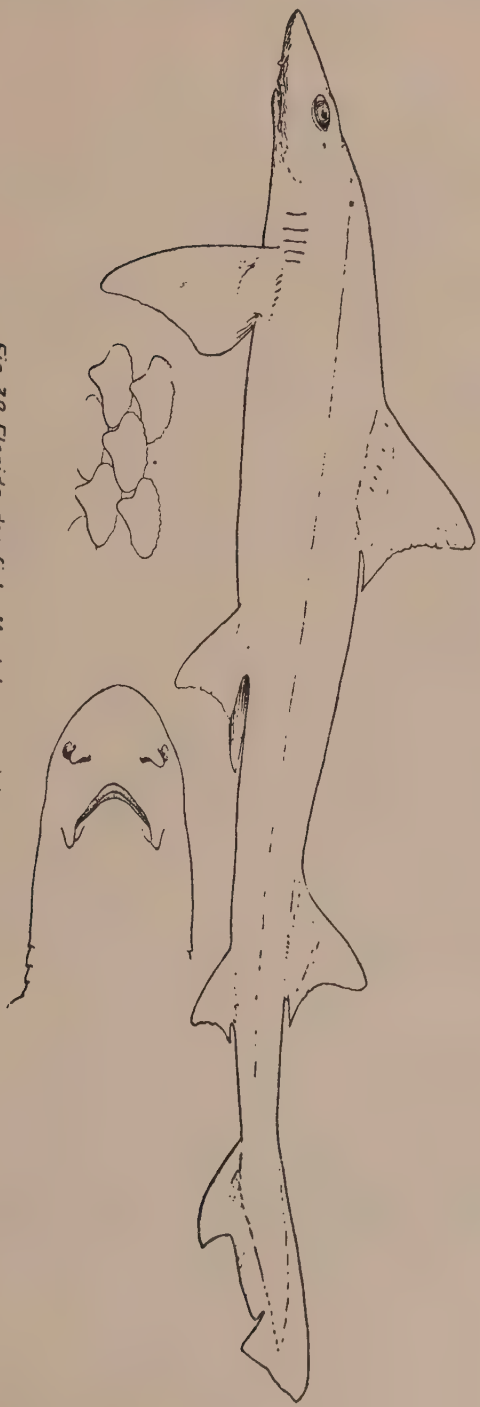


Fig. 38 Florida dog fish, Mustelus norrisi

Figure 39

Family Triakidae, Smooth Dog Fishes.

Genus *Mustelus,* Smooth Dog Fishes. **The nostril is not connected with mouth and does not bear a barbel; the teeth are low, rounded and without definite cusps.**

Figure 39. Mustelus canis, Common Smooth Dog Fish.

Description: Trunk slender; snout moderately long and blunt-tipped; eye rather large; gill openings noticeably short, a little longer than the horizontal diameter of the eye; the teeth (the most distinctive feature of the genus) low, with bluntly rounded apex directed a little toward the corners of the mouth, similar in the two jaws, but a little more numerous in the lower (about 80) than in the upper (about 75), in mosaic arrangement, several series being in service simultaneously; mid-point of the base of the first dorsal about as near to the axil (armpit) of the pectoral as to the origin of the pelvics; second dorsal 2/3 to 4/5 as high as the first dorsal; pectoral with nearly straight distal margin and with rounded corners.

Color: Plain olive-slaty or brownish gray above, with the margins of the fins paler; yellowish or grayish white below.

Size: Born at a length of 14 to 15 inches, it matures at three feet or less and occasionally grows to about five feet.

Habits: An inshore species usually in depths of less than ten fathoms and often close in to the land in bays and harbors, occasionally entering fresh water; feeding chiefly on the larger crustacea, such as crabs and lobsters, of which it is a destructive enemy; also on squid and on any small fish that may be available. On the northern part of its range, mating takes place in late summer and the young are born between early June and mid-July. The breeding season of the southern stocks of the species is not known.

Range: Western Atlantic. North abundantly to Cape Cod or still farther as a stray; south to Central Brazil and Uruguay. This species is known in Cuban waters, around Jamaica and at Trinidad and is to be expected throughout the West Indian-Caribbean region. Very little, however, is known about its occurrence there. By contrast, it is one of the commonest of sharks along the coast of the United States from North Carolina to southern New England, where it is a regular migrant, north in spring, southward again in autumn. Present indications also are that there is but little interchange between the northern and southern populations, for it does not seem to occur at all along the east coast of Florida.

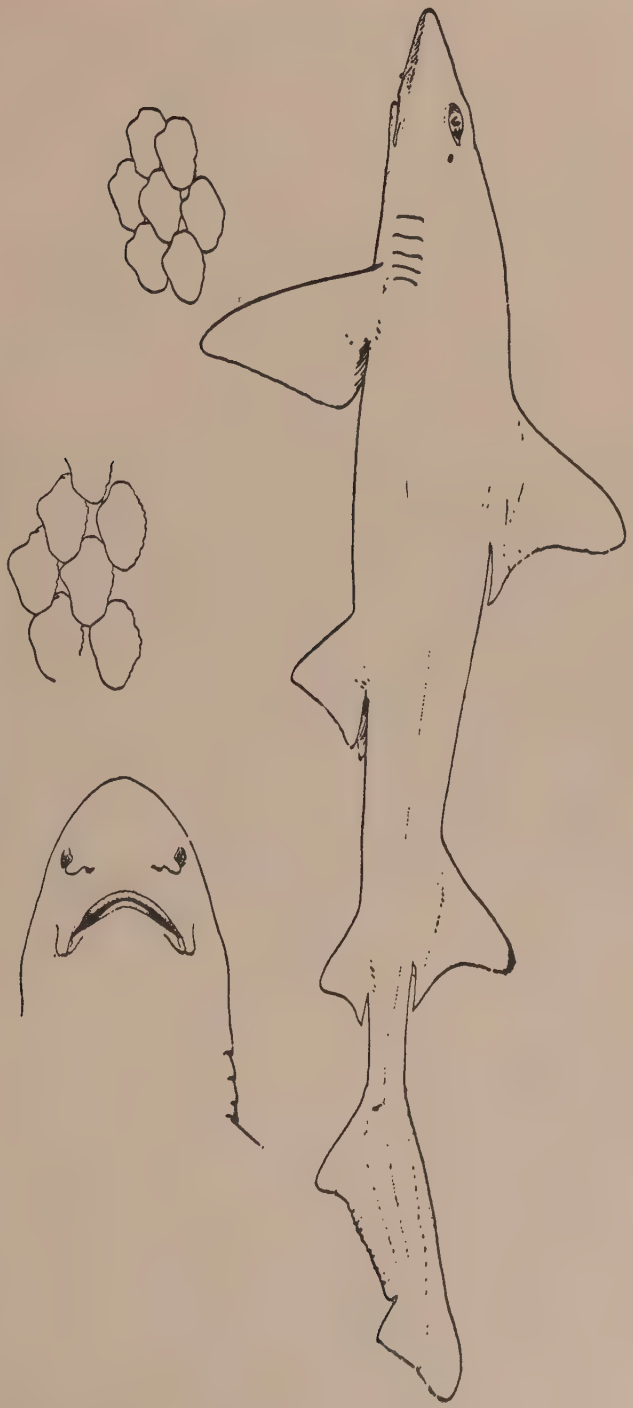


Fig. 39 Common smooth dog fish, Mustelus canis

Figure 40

Family Scyliorhinidae, Cat Sharks. Only five gill openings; two dorsal fins (rarely only one dorsal) and an anal, the first dorsal overlapping the pelvics; the caudal much less than 1/2 the total length of the shark, its axis raised but little, without a definite lower lobe. Sides of the trunk without long ridges; fourth or fourth and fifth gill openings over the origin of the pectoral fin, nostril does not have a well-developed barbel. Teeth small, numerous, similar in the two jaws, with three or more cusps, and several series in service simultaneously.

These little sharks (all the species are small) are interesting chiefly for the fact that all of them (so far as known) lay horny-shelled eggs. Six species are known from the West Indian region, all of them confined to moderately deep water and none of them are plentiful.

Figure 40. One species, *Scyliorhinus torrei,* is pictured here to facilitate identification, should any of them be caught.

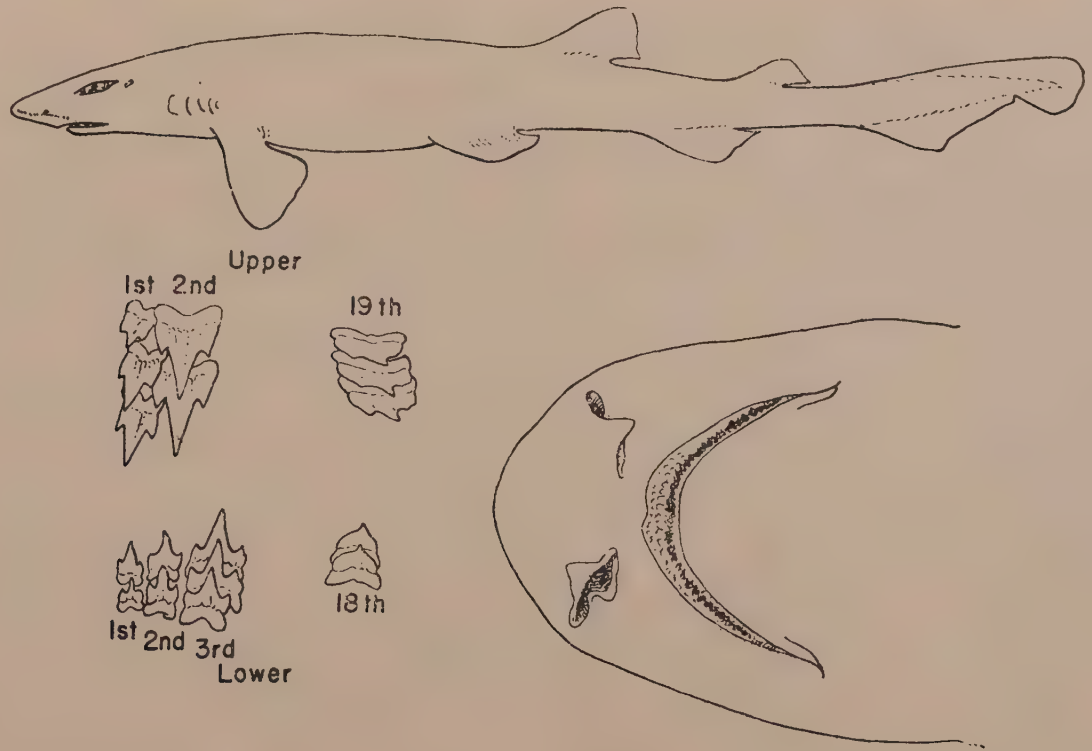


Fig. 40 Cat shark, Scyliorhinus torrei

Figure 41

Family. Eulamidae, Requiem Sharks. Only five gill openings, the fourth or fifth over the origin of the pectoral. Two dorsal fins and an anal, the first dorsal entirely in front of the pelvics; caudal much less than 1/2 the total length of the shark; its axis but little raised, and not lunate, but with a definitely outlined lower lobe; eye with a well-developed nictitating ("winking") membrane inside the lower lid; nostril not connected with mouth and without barbel; teeth blade-like with only one main cusp; only one series in service simultaneously along the sides of the mouth, or at the most two, depending on the stage in their replacement.

Genus *Negaprion,* Lemon Sharks. No spiracles and no long ridges on the caudal peduncle; mid-point of the base of the first dorsal as near to the axil (armpit) of the pectoral as to the origin of the pelvics, or nearer; no furrow on the lower jaw and only a very short one on the upper; teeth erect and symmetrical toward center of mouth but oblique toward its corners, their cusps smooth-edged with the bases often more or less wavy or irregular.

Figure 41. Negaprion brevirostris. Lemon Shark.

Description: Trunk moderately stout; snout very short and broadly rounded; gill openings about 1-1/2 to 2 times as long as the diameter of the eye; teeth narrow, triangular, with smooth-edged cusps, those toward the corner of the mouth increasingly oblique and with their outer edges notched; second dorsal fin very nearly as large as the first dorsal (this is the most distinctive character of the shark among the local members of its family); lower lobe of the caudal about 1/2 as long as the upper lobe; posterior margins of the anal much more deeply concave than that of the second dorsal; pectoral about 2/3 as broad as long, thus relatively broader than in other related species of the region.

Color: Usually yellowish brown above, but sometimes dark brown or bluish gray with yellowish tinge; white or pale yellowish below, the anal usually yellowish and edged with gray; the other fins with or without dark edges.

Size: Matures at about 7 to 7-1/2 feet and grows to a maximum length of about 11 feet.

Habits: This is an inshore species common around docks and in creeks and inlets as well as along open coasts. Around southern Florida its young are born in spring and summer. Probably this occurs at the same season in the Caribbean. It is a fish eater (its diet includes sting-rays), and it readily takes a hook baited with fish. It has been accused of attacks on bathers.

Range: Both sides of the Atlantic; from northern Brazil to North Carolina and accidentally to New Jersey on the American coast. This is one of the more plentiful of the larger sharks around southern Florida where it provides a considerable part of the catches of the shark fishery. Its center of abundance probably covers the West Indian-Caribbean region as a whole, although it

has been reported by name there only from the Bahamas, Cuba, Jamaica and the Atlantic Coast of Panama.

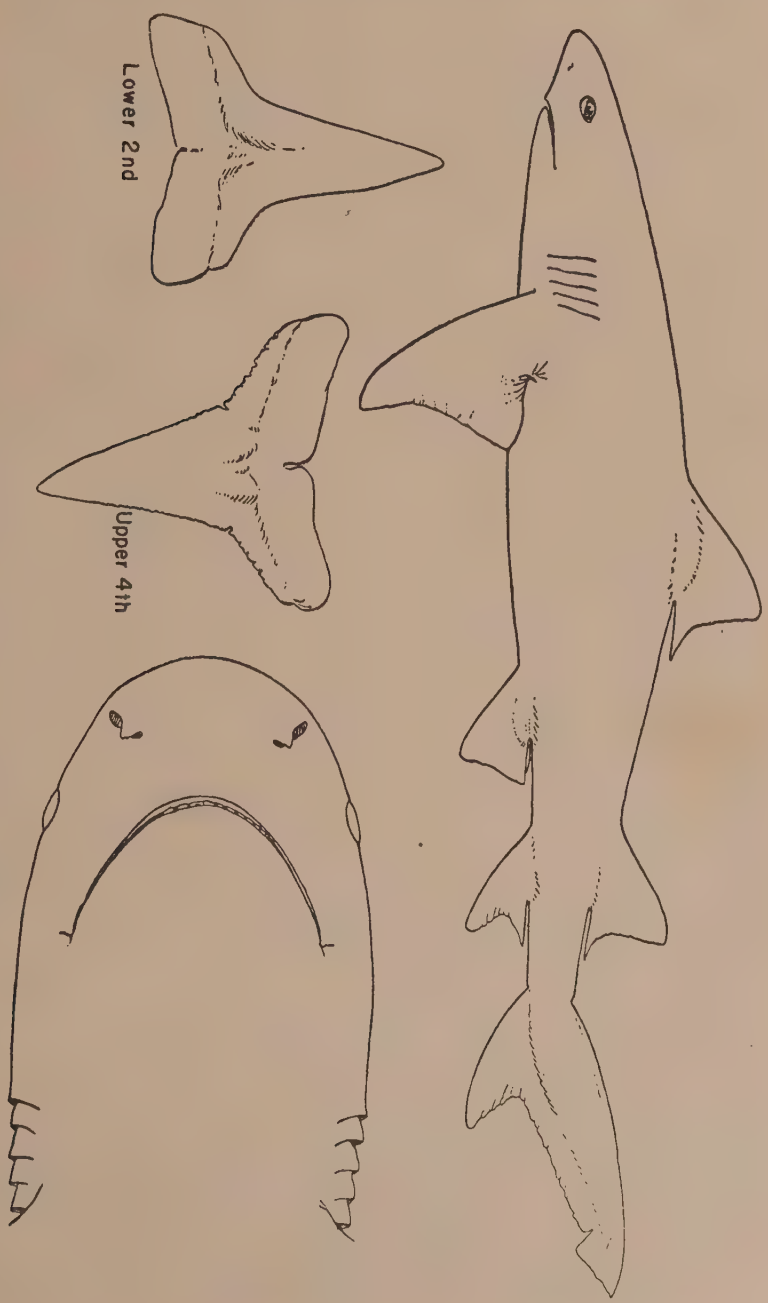


Fig. 41 Lemon shark, Negaprion brevirostris

Figure 42

Family Eulamidae, Requiem Sharks.

Genus *Galeocerdo,* Tiger Sharks. Spiracles present and easily seen; caudal peduncle with a low long skin ridge on each side; labial furrow on upper jaw as long as snout in front of mouth.

Figure 42. Galeocerdo cuvier, Tiger Shark; Leopard Shark.

Description: Trunk heaviest opposite the first dorsal and tapering rearward; a low ridge along the mid-line of the back between the two dorsals and a low ridge along each side of the caudal peduncle; snout noticeably short and very broadly rounded; spiracle easily visible as a slit; longest gill opening about 1-1/5 as long as horizontal diameter of eye; upper jaw with a well-marked furrow, extending from corner of mouth to about opposite the front edge of the eye, and furrow on lower jaw about 1/2 that long; teeth 9 to 12 on each side in each jaw, the uppers similar and very characteristic in shape; their edges finely serrate toward the tip but coarsely so toward the base. Second dorsal about 1/2 as long as first and 1/3 as high; caudal very distinctive in outline, with a very slender pointed tip and a narrow sharp-pointed lower lobe a little more than 1/3 as long as the upper lobe; anal similar to second dorsal and below it; pectoral about 1/2 as long as the distance from end of snout to fifth gill opening, with moderately concave distal margin and narrowly rounded corners.

Color: Gray or grayish brown above; a paler shade of the same below; small specimens up to 5 or 6 feet long are more or less prominently marked with darker brown spots, often fusing irregularly into oblique or transverse bars; these fade with growth, large ones often being but faintly marked or even plain colored.

Size: While only 18 to 20 inches at birth, this is one of the larger sharks at maturity with adults averaging about 12 to 14 feet. Occasionally it is as long as 18 feet and is reputed to grow considerably larger still. They may be expected to weigh 700 to 850 lbs. at 11 to 12 ft., 850 to 1,300 lbs. at 12 to 13 ft., and 1,000 to 1,400 lbs. at 13 to 14 ft., depending on fatness and (for gravid females) on the stage of development of the embryos.

Habits: Found indifferently far out at sea and close inshore, and even on flats in a few feet of water. Except when in pursuit of food, this is rather a sluggish shark. When so stimulated, however, it is one of the most vigorous and strong-swimming. One of the most voracious of its kind, its diet ranges from crabs and small fish to large fish, sea turtles and seals. It also has a great tendency to frequent the entrances to harbors or waters near canning factories and slaughter houses from which waste is dumped. Its larger, saw-edged teeth are extremely efficient cutting instruments. It is a common habit for it to bite great chunks from other sharks that it may find entangled in nets. It is well known as a scavenger, feeding on offal of any kind. In West Indian

waters it is regarded as perhaps the most dangerous of local species.

Range: Widespread in the tropical and subtropical belts of all the oceans, this is perhaps the most numerous of the larger sharks throughout the West Indian-Caribbean region where it is to be expected anywhere and at any time. It contributes largely to the catches of the shark-fisheries.

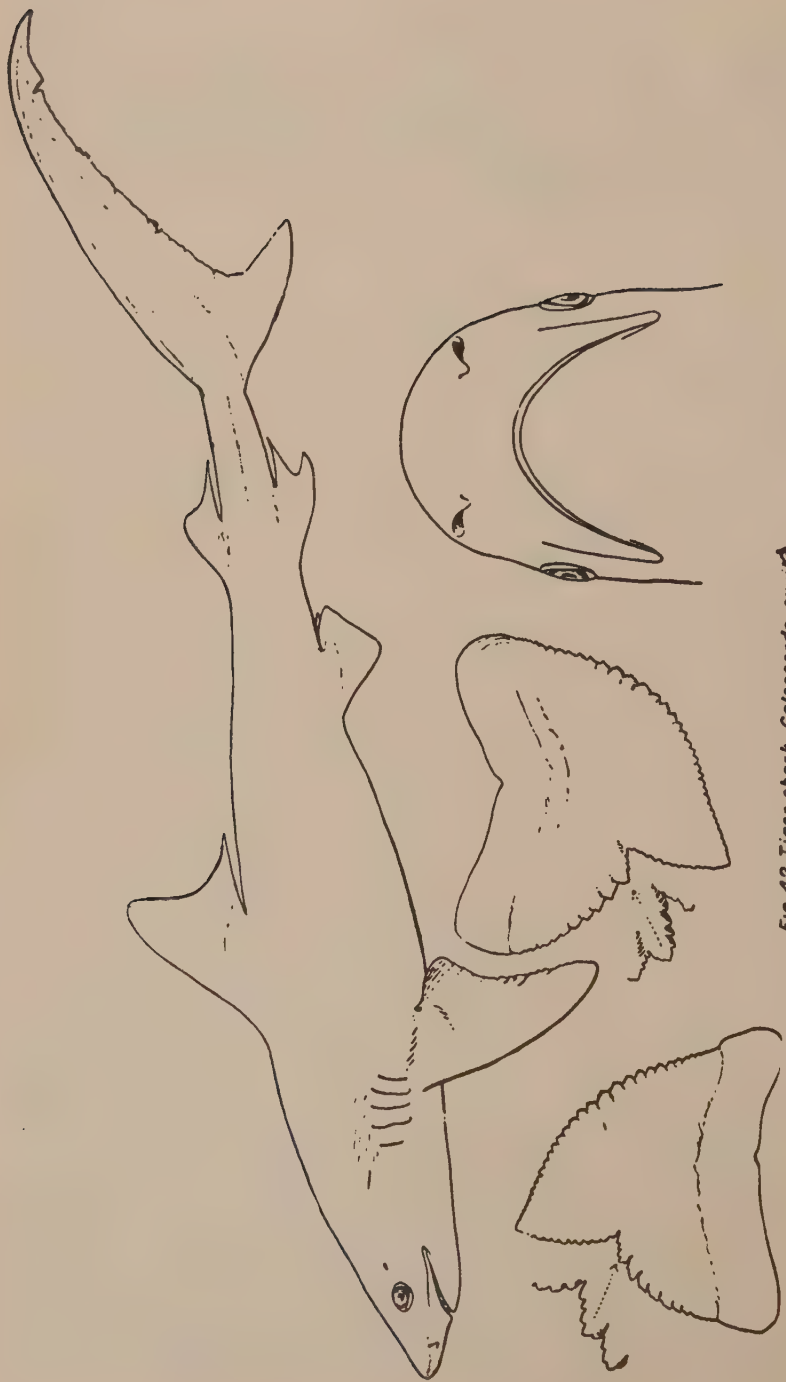


Fig. 42 Tiger shark, Galeocerdo cuvieri

Figure 43

Family. Eulamidae

Genus *Prionace,* Blue Sharks. No spiracles; no longitudinal ridges on sides of caudal peduncle; furrow on upper jaw so short that it is apt to be overlooked and none on the lower; mid-point of first dorsal fin is considerably nearer to the origin of the pelvics than to axil (armpit) of the pectoral.

Figure 43. Prionace glauca, Great Blue Shark.

Description: Trunk noticeably slender; snout conical with narrowly rounded tip and noticeably long; gill openings short, the longest about as long as the horizontal diameter of the eye (this relationship alters somewhat with growth); in the upper jaw there are 14 teeth on each side (sometimes with smaller tooth at the center), and in the lower jaw 13 to 15 on each side with 1 to 4 small ones in the center, uppers a little broader than long, oblique, their outer margins deeply concave and inner margins convex and their edges serrate; lower erect, more slender than uppers, usually very finely serrate but occasionally smooth; base of second dorsal fin about 1/2 as long as base of first dorsal; caudal with narrowly pointed tip and lower lobe, the latter about 1/2 as long as the upper lobe; anal similar, a little smaller than the second dorsal and below it; pelvics noticeably small, being about as large as the anal; pectoral noticeably long (about as long as the distance from end of snout to the fifth gill opening); only about 1/3 as broad as long, with moderately convex front and concave distal margins and narrow tip.

Color: Living specimens are dark indigo-blue along the back, shading to a clear bright blue along the sides and to snow-white below. They soon fade after death to a slaty or sooty gray.

Size: Born at a length of 20 to 30 inches and maturing at about 7 to 8 ft., the Blue Shark grows commonly to 10 to 12 ft. While it is credited with reaching 15 to 20 feet, there is no positive proof of this. Because of their slender build recorded weights are only about 100 to 120 lbs. at 7 to 8 ft. and 150 to 200 lbs. at 9 feet.

Habits: This is a shark of the high seas, its wanderings chiefly governed by its search for food or as it may drift with some ocean current. It is often seen at the surface and there is no reason to suppose that it ever decends to any great depth. When not disturbed it is rather sluggish, but it swims powerfully and swiftly when in pursuit of prey. It feeds on whatever of the smaller schooling fishes are available locally. They also consume large quantities of bottom fish on the Fishery Banks. No evidence of their preying on larger animals while these are alive. Their habit of gathering (probably following up the blood scent) to gorge on the carcasses of whales has long been known among sperm-whalers, by whom it has always been held in contempt.

Range: In the tropical, subtropical and warm temperate belts of all oceans it is known along the eastern coast of America as far

north as Nova Scotia and the Newfoundland Banks and as far south as Brazil and the offing of the Rio Plata. It is often seen and occasionally caught out in the open sea around Cuba. It is to be expected generally throughout the West Indian and Caribbean region out from the land, although actually there are only few definite reports of its presence there.

Fig. 43 Great blue shark, Prionace glauca

Figure 44

Family Triakidae, Smooth Dog Fishes.

Genus *Triakis.* Resembles *Mustelus,* except that the teeth have 2 to 4 pointed cusps.

Figure 44. Triakis barbouri, Pigmy Dog Fish.

Description: Trunk slender; the snout broad-oval; the gill openings shorter than the horizontal diameter of the eye; 30 to 31 teeth on each side of upper and lower jaws, in three to six functional series; the uppers with three cusps, the middle one of which is much the longest; the lowers similar toward the center of the mouth, but those along its sides and especially those toward its corners have two or three short cusps on the inner side, but none on the outer, with the result that the primary cusps stand at the outer edge of the tooth. The second dorsal fin about as large as the first dorsal; the caudal without a definite lower lobe; the anal a little smaller than the second dorsal and below it; the pelvics only about as large as the anal; the pectoral with nearly straight distal margin and with rounded corners.

Color: Pale gray above; grayish white below; the anterior edges of each dorsal fin and of the caudal (mid-way of its length) often with a dusky blotch.

Size: This is one of the smallest of sharks. Its maximum length perhaps not greater than about 1 foot 2 to 4 inches.

Habits: All that is known of its habits is that it has been taken in moderately deep water (between 235 and 335 fathoms).

Range: So far it is known only off the north coast of Cuba. It is included because it is so very plentiful there that any trawler, operating at appropriate depths would be likely to take a large number.

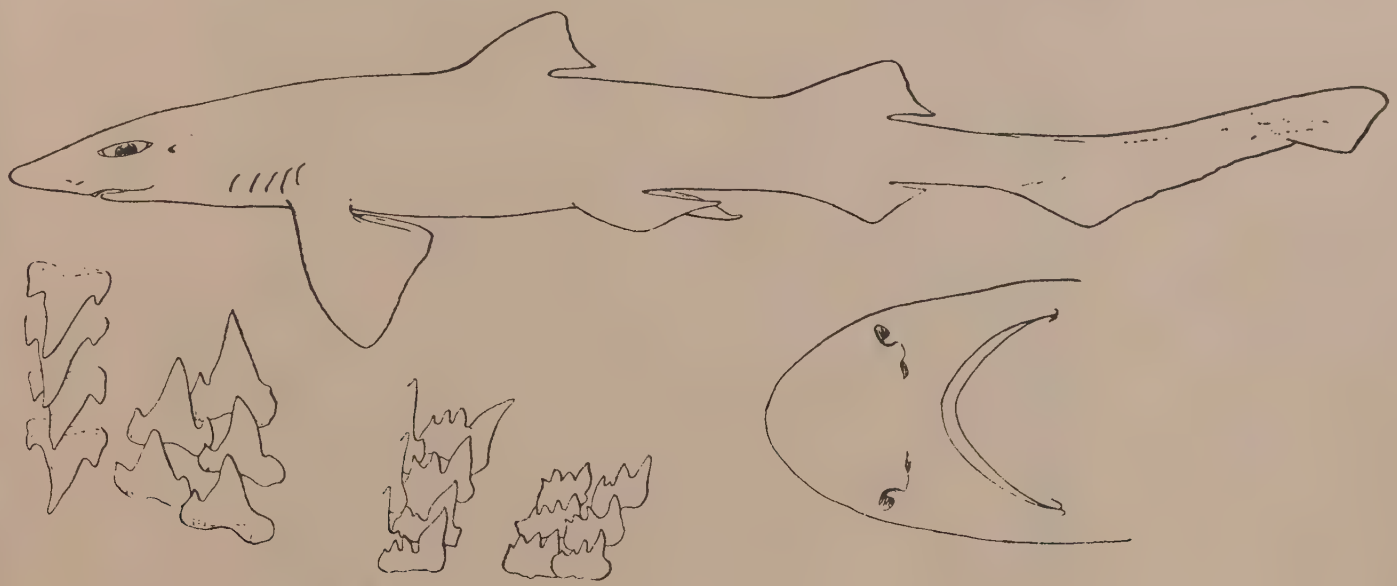


Fig. 44 Pigmy dog fish, Triakis barbouri

Figure 45

Family Eulamidae

Genus *Aprionodon,* Smooth-Toothed Sharks. No spiracles; no longitudinal ridges on the caudal peduncle; mid-point of base of first dorsal as near to axil (armpit) of pectoral as to origin of pelvics or nearer; furrow around the corner of the mouth and on to each jaw; teeth alike in the two jaws, very slender, erect, with smooth edges.

Figure 45. Aprionodon isodon, Smooth-Toothed Shark.

Description: Trunk rather slender; snout moderately pointed; gill openings noticeably large (the species' most obviously distinctive character), the longest being more than twice as long as the diameter of the eye and 2/3 as long as the snout in front of the mouth; furrows on the jaws very short, the lower usually concealed when the mouth is closed; teeth very slender, needle-sharp, on broad bases, rather widely spaced, about 13 to 15 in each side of the mouth on each jaw. The second dorsal fin about 1/2 as long at the base as the first dorsal and stands over the anal; lower lobe of the caudal between 1/3 and 1/2 as long as the upper lobe; anal with posterior margin much more deeply concave than that of the second dorsal; pectorals small, being only about 1/2 as long as the head (snout to fifth gill opening), with only slightly concave distal margin and a narrow tip.

Color: Slate blue above; pure white below.

Size: The largest so far reported was about 4 feet long but it may grow considerably larger.

Habits: Nothing definite is known of its habits or diet.

Range: Both sides of the Atlantic; Cuba to New York along the American coast. While this shark has seldom been reported, it is to be expected throughout the Caribbean area, for it appears to be a tropical species and is known from Southwestern Florida, from Cuba and from the northern and northwestern shores of the Gulf of Mexico.

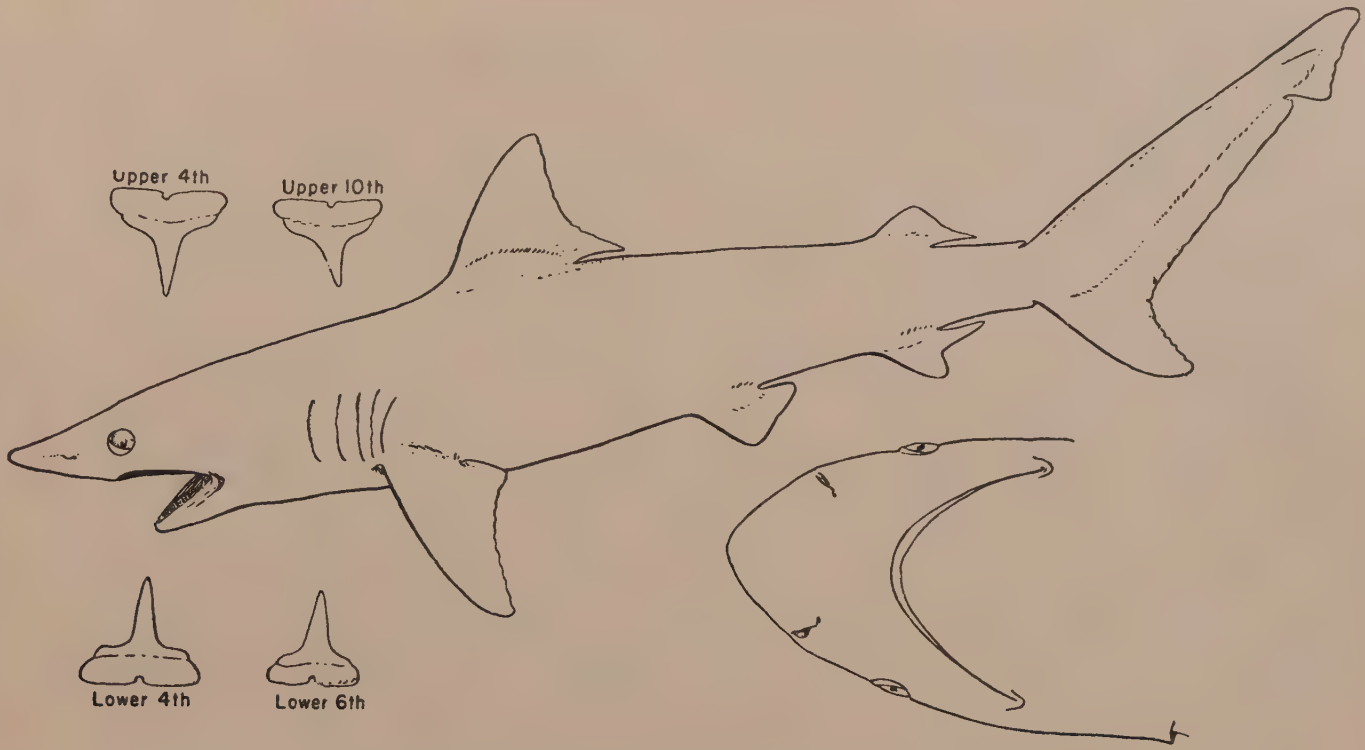


Fig. 45 Smooth-toothed shark, Aprionodon isodon

Figure 46

Family Eulamidae.

Genus *Scoliodon,* No spiracles; and no longitudinal ridges on the caudal peduncle; mid-point of base of first dorsal about equidistant between the origin of the pelvics and the axil of the pectoral; furrow on upper jaw (if present) is much shorter than the snout in front of mouth; upper and lower teeth alike, those along side of jaw broad, oblique, with their outer margins deeply notched, their edges smooth or at most only slightly wavy.

Figure 46. Scoliodon terrae-novae, Sharp-Nosed Shark.

Description: Trunk slender; the snout flattened above, tapering to narrowly rounded tip and varying considerably in shape in different specimens; gill openings a little longer than the diameter of the eye, the fourth over the origin of the pectoral; a well-marked furrow, extending around the corner of the mouth and for a short distance along each jaw, is a distinctive character among similar species; the teeth, similar in the two jaws, are also distinctive in shape—those along the sides of the jaws being broader than high, smooth edged and very oblique, with the outer margins deeply notched. The base of the second dorsal fin about 1/3 as long as that of the first dorsal but similar to it in shape, its origin about over the mid-point of the base of the anal; lower lobe of the caudal a little more than 1/3 as long as the upper lobe; the anal similar to the second dorsal in shape but about 1-1/3 as long at the base; the pelvics a little longer at the base than the anal, being only about as long as the front edge of the first dorsal; the pectorals noticeably small with moderately concave distal margin and well rounded tip.

Color: Brownish to olive gray above, with the dorsal and caudal fins more or less dark-edged; white below.

Size: About 11 to 16 inches at birth; adults commonly 26 to 30 inches long; maximum recorded length about 36½ inches.

Habits: Often taken right along the beach. Also in enclosed bays, sounds, harbors and occasionally in brackish or even in tidal fresh water. It has never yet been reported more than a mile or two out at sea. It feeds chiefly on small fish of whatever kinds are available, also on shrimps and mollusks. It bites freely on almost any bait. Young are born chiefly in late spring and summer in the northern part of its range, but their season is not known for tropical waters.

Range: Both sides of the tropical and subtropical Atlantic; Uruguay to North Carolina along the American Coast and occasionally straying as far north as the Bay of Fundy. This little shark occurs generally throughout the West Indian-Caribbean regions and is so plentiful locally as to be a nuisance because of its habit of taking the baits intended for more desirable fish.

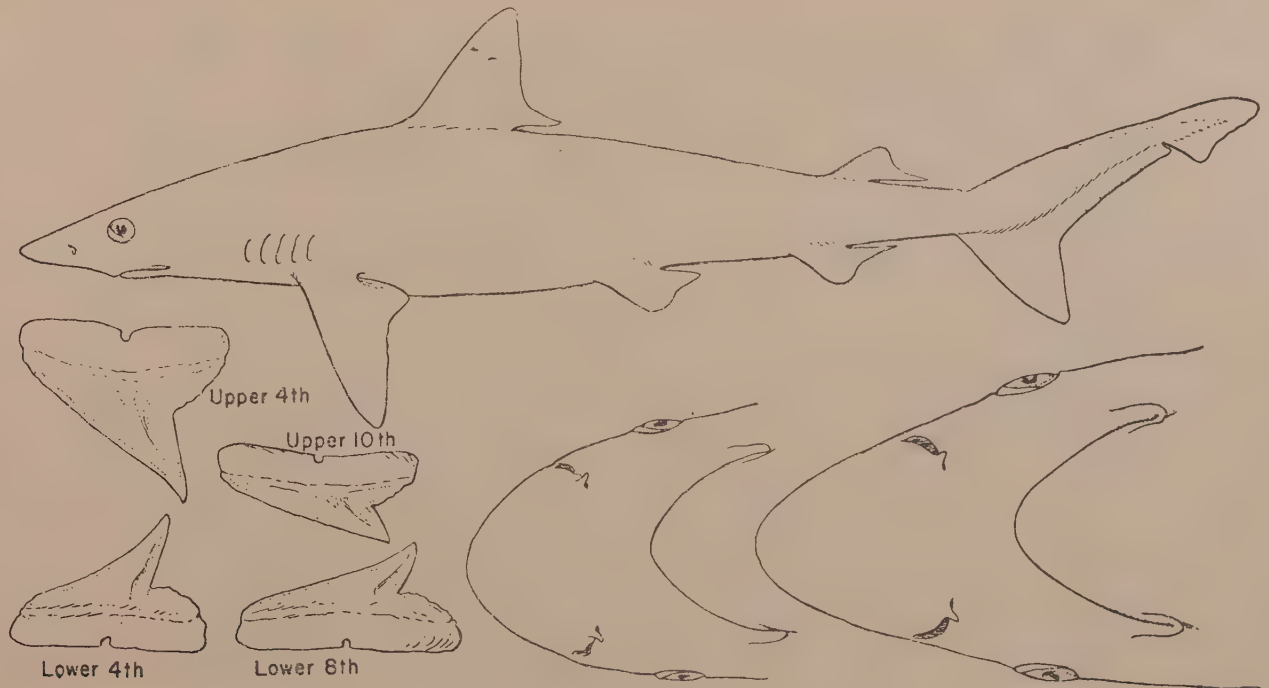


Fig. 46 Sharp-nosed shark, Scoliodon terrae-novae; showing broad and sharp nose types of head

Figure 47

Family Eulamidae

Genus *Hypoprion*, Night Sharks. No spiracles; no longitudinal ridges on the caudal penduncle; mid-point of the base of the first dorsal is at least as near to the axil (armpit) of the pectoral as to the origin of the pelvics; no furrow on the lower jaw and only a very short one on the upper; teeth with smooth edged cusps, but the uppers with several coarse serrations or small denticles toward the base on the outer side.

Figure 47. Hypoprion signatus, Night Shark.

Description: Trunk comparatively stout with a low but unmistakable ridge along the mid-line of the back between the two dorsal fins; the head noticeably long, occupying about 1/3 of the length of the trunk to the origin of the caudal; snout narrow and rounded at tip; gill openings noticeably small and about as long as the diameter of the eye; anterior margin of the nostril with a well-marked, narrow-triangular lobe near its inner end; upper teeth narrow-triangular, increasingly oblique toward the corners of the mouth and with their outer margins deeply notched; lower teeth more slender than uppers, symmetrical and nearly erect; second dorsal fin a little less than 1/2 as long at the base as first dorsal and relatively much lower; lower lobe of caudal about 2/5 as long as upper lobe; anal about as large as second dorsal but with much more deeply concave rear margin; pectoral about 2/3 as long as head with weakly and evenly concave distal margin and narrowly rounded corners.

Color: Bluish gray above, sprinkled with small black spots; grayish white below.

Size: The few specimens so far measured have ranged from about 38 inches to about 12 feet, 6 inches long.

Habits: The only available information is that Cuban fishermen reported it as caught well off shore on set lines at depths greater than 150 fathoms, and only at night.

Range: So far known positively from stray specimens off South Carolina and from the north coast of Cuba, where, however, it is so common that thirty-six large ones have been landed at one time at the Fishery Station at Cojimar.

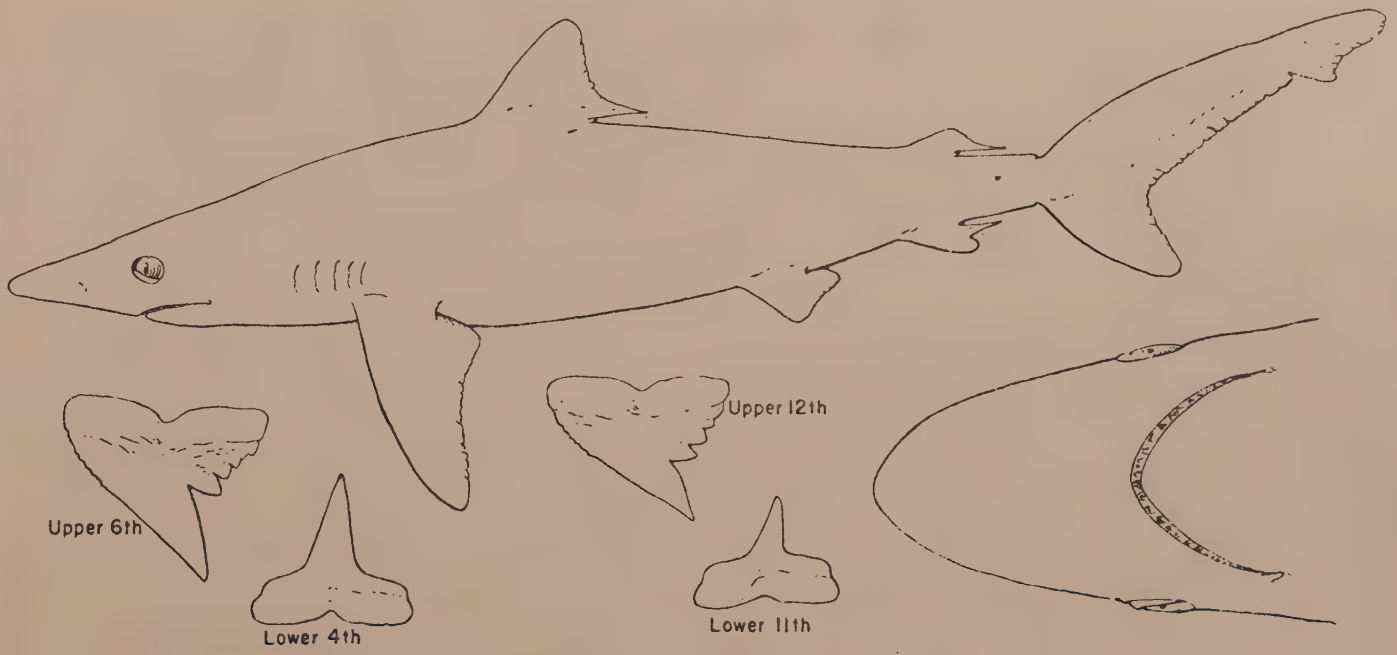


Fig. 47 Night shark, Hypoprion signatus

Figure 48

Family Sphrynidae, Hammerhead Sharks. Sharks with the head much flattened above and below and very widely expanded sideways in the form of a "hammer" or "bonnet" and with the eyes at its outer edges. Otherwise the characters are in general like the family Eulamidae.

Genus *Sphyrna.* Characters as in family and with nostrils much closer to the eyes than to the mid-line of snout.

Figure 48. Sphyrna tiburo, Bonnet Shark, Shovel-head.

Description: Trunk moderately flattened sideways; head "shovel"—not "hammer"—shaped, the front contour being an uninterrupted curve from eye to eye without definite depressions opposite nostrils; the distance from nostril to eye is slightly greater than diameter of eye; the corners of mouth are slightly in front of the outer rear corners of the head or "shovel"; diameter of eye about 1/4 to 1/5 as long as length of head in front of mouth; length of first gill opening about 1-1/2 times diameter of eye; fifth gill opening over origin of pectoral; teeth are in 12 to 14 rows on each side of upper jaw and in 12 rows on each side of lower, with one very small tooth usually in the center of both upper and lower jaw; in the upper jaw the first tooth from center is erect, but the subsequent teeth become increasingly oblique; in the lower jaw the first 1 to 3 teeth are erect, the next 4 or 5 are slightly oblique and the few near corners of mouth are low, oval and have no cutting edge; free rear margin of second dorsal about 1/3 as long as vertical height of fin and not longer than its front margin; pelvics with weakly convex front margin and weakly concave rear margin; and rear margin weakly concave.

Color: Gray or grayish brown above and paler shade of same hue below. Some fish have a few small round dark spots on the sides, but there are no conspicuous fin markings.

Size: Seldom exceeds 5 feet, with 6 feet about the maximum.

Habits: Found chiefly in shallow water and close inshore (less than 5 fathoms), often in bays and estuaries. It feeds largely on crabs and shrimps, but also takes mollusks, octopuses, small fish and almost any animal it can capture.

Range: Tropical and warm temperate belt of the Atlantic Ocean from southern Brazil to North Carolina and, as a stray, to southern New England and Massachusetts Bay; apparently found in tropical West Africa and also on the Pacific coasts of America from southern California to Ecuador.

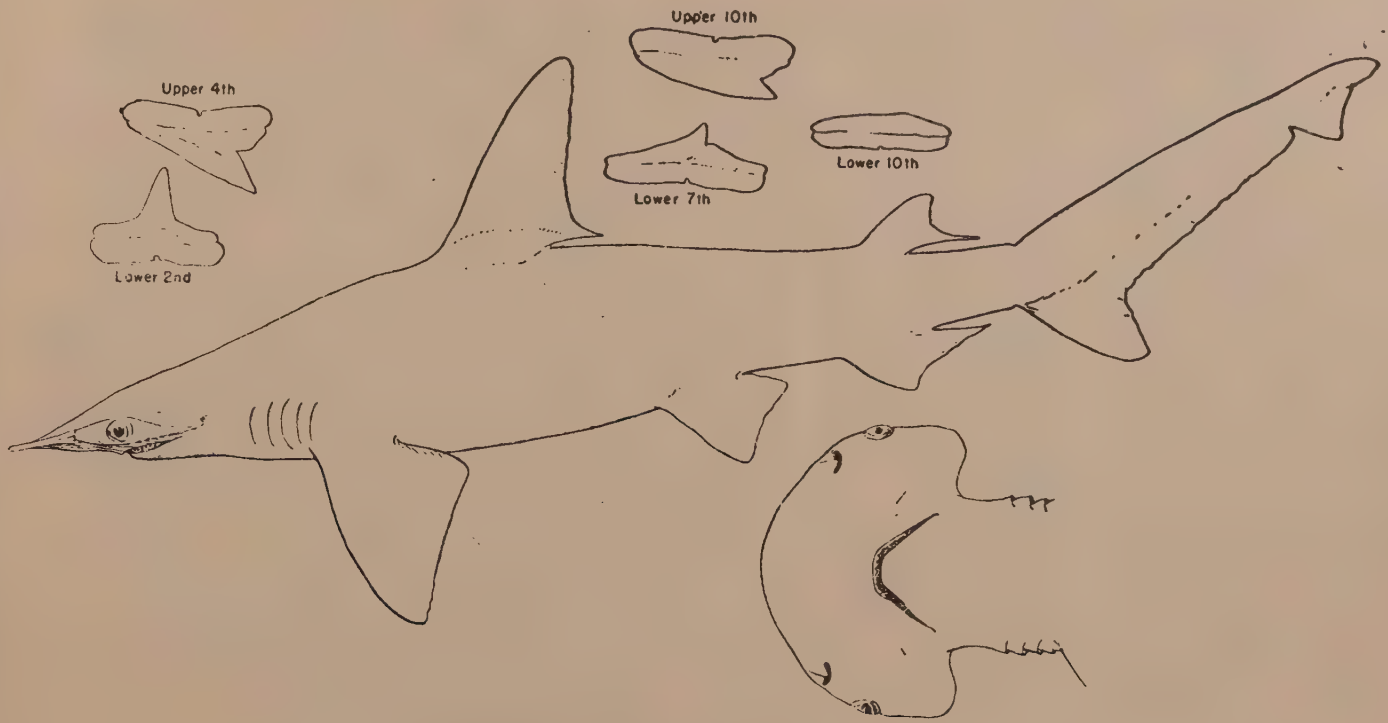


Fig. 43 Bonnet shark, Sphyrna tiburo

Figure 49

Family Sphrynidae, Hammerhead Sharks.

Figure 49. Sphyrna zygaena, Common Hammerhead.

Description: Trunk strongly flattened from side to side; the front contour of head with a deep depression opposite each nostril and a shallow depression midway between each nostril and the mid-line of the head. The mid-line, however, is evenly convex and has no indentation as has *Sphyrna diplana* and *S. tudes;* the distance from nostril to eye is only about 1/2 as great as the diameter of the eye (about as great as eye in *diplana);* the corners of the mouth are slightly in front of the rear margin of the head or "hammer"; diameter of eye about 1/3 as long as head in front of mouth; length of first gill opening a little less than diameter of eye; fifth gill opening over origin of pectoral fin; the teeth are broadly triangular and there are 15 teeth on each side of upper jaw and 13 on each side of lower jaw which also has a small tooth in the center; the 1st upper tooth is nearly symmetrical and erect but the others are strongly oblique; the lower teeth resemble the uppers toward corners of mouth except that they are a little smaller, but the 4 teeth next to center of mouth are narrower and less oblique than the uppers; free rear margin of second dorsal is about twice the vertical height of the fin and about equal to front margin; rear margin of anal fin deeply concave.

Color: Deep olive-leaden or brownish gray above, paler on sides, shading into pure or grayish white below; tips or margins of fins more or less dusky; the pectoral fins are black-tipped in some specimens but not in others.

Size: Born at a length of about 20 inches; adults appear to mature at about 8 to 9 feet. They are often caught up to 10 or 11 feet and occasionally to 13 feet.

Habits: A strong swimming shark often seen at surface with tips of first dorsal and caudal fins exposed. Many are found far out at sea as well as close inshore, where small ones are often taken with beach seines. Their diet consists chiefly of fish, commonly sting rays and small sharks, including their own kind. They also eat shrimps, crabs, barnacles and other crustacea, as well as squid.

Range: Tropical and warm temperate belts of the Atlantic. In the western Atlantic it is found from southern New England to Uruguay, straying northward to Nova Scotia and southward to northern Argentina. Many previous records are confused with its close relative, *S. diplana,* but it is undoubtedly widespread along the middle Atlantic coast of the United States, the West Indian-Caribbean region, and the coast of northern Brazil.

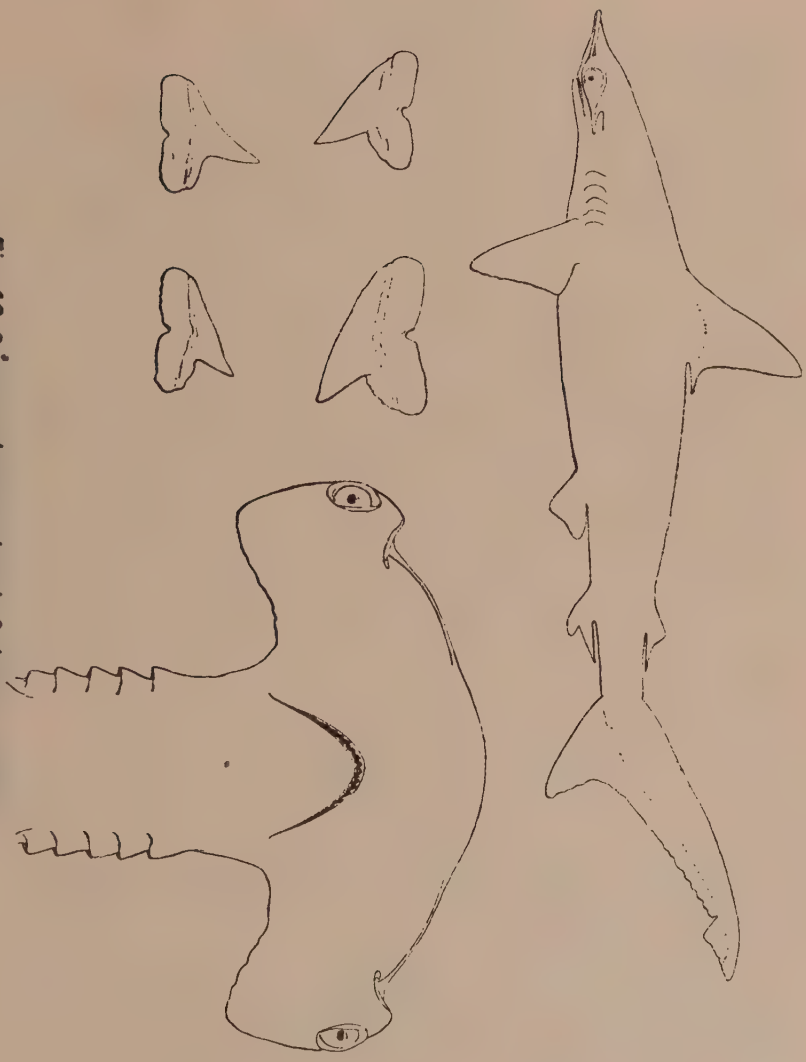


Fig. 49 Common hammerhead, Sphyrna zygaena

Figure 50

Family Sphrynidae, Hammerhead Sharks.

Figure 50. Sphyrna diplana, Hammerhead.

Description: Trunk strongly flattened sideways; head with a slight but noticeable indentation in front in the mid-line (there is no indentation in *Sphyrna zygaena);* the front margin of the head is also scalloped with a deep rounded depression opposite each nostril; the distance from the nostril to the eye is about as long as the diameter of eye (only about 1/2 that long in *zygaena);* the corners of the mouth are well in front of the outer rear corners of the head or "hammer"; a line connecting outer ends of nostrils passes a little in front of the mouth; eye nearly circular, its diameter about 1/3 as long as head in front of mouth; first gill opening a little more than 1-1/2 as long as diameter of eye, the fifth gill opening being above the origin of the pectoral fin; there are 15 or 16 teeth on each side of the upper and lower jaws and usually one or two very small ones in the center of the jaws; the teeth are triangular in shape on expanded bases and the cusps are smooth edged (serrated in *Sphyrna tudes*); the first tooth from the center of jaw is much smaller than the second, and the fifteenth and sixteenth at the corners of the mouth are very small indeed. The free rear tip of the second dorsal is much longer than its vertical height and at least as long as the front margin of the fin; pelvic fins have nearly straight margins and rear margin of anal is deeply concave.

Color: Light gray above, shading to white below; the pectorals tipped with black on their underneath surfaces.

Size: A moderately large shark; young are about 16 inches long when born and grow to a length of about 8 feet and probably longer.

Habits: As this species had been confused with its close relative, *Sphyrna zygaena,* until recently, there is little known specifically of its habits. It is probable, however, that they are very similar to the latter. (Figure 49.)

Range: Tropical and warm temperature Atlantic, probably also in the Mediterranean. It is known from Rio de Janeiro, Gulf of Mexico and as far north as Delaware. Because of past confusion with *Sphyrna zygaena* little is known of its abundance and distribution in the Caribbean region, but it very probably is more or less common there.

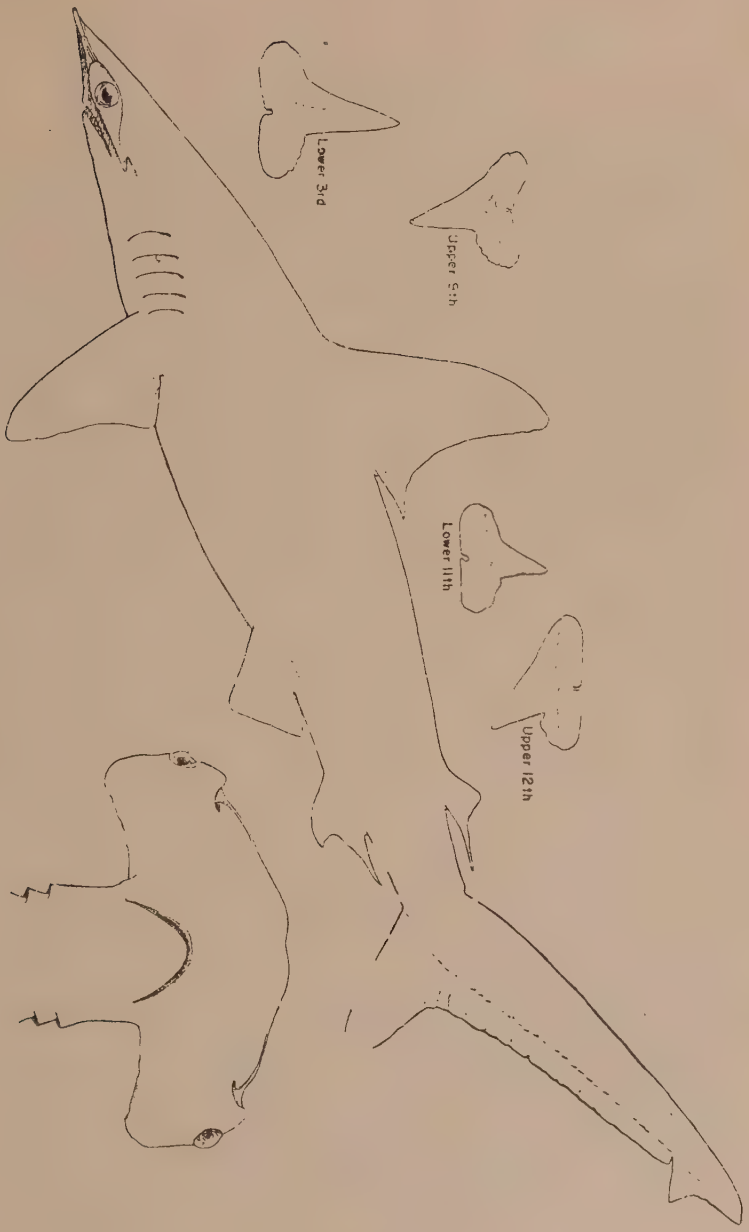


Fig 50 Hammerhead, Sphyrna diplana

Figure 51

Family Sphrynidae, Hammerhead Sharks.

Figure 51. **Sphyrna tudes, Great Hammerhead.**

Description: Trunk moderately flattened from side to side. The front contour of head with a depression opposite each nostril and a shallow but noticeable indentation at the mid-line of head; the distance from nostril to eye is about equal to diameter of eye; in adults the corners of mouth are slightly behind the rear margin of the head or "hammer", but in newborn and very young specimens the rear corner of mouth is slightly in front; diameter of eye about 1/3 as long as head in front of mouth in young fish, but increasing so little in size in large ones that it may be only about 1/5 as long; length of first gill opening about 1-1/3 times diameter of eye in young, but 2 to 3-1/3 times in medium sized specimens and as much as 4 times the eye in large fish (around 10 feet long); 4th gill opening over origin of pectoral; there are 17 teeth on each side of the upper jaw and 16 or 17 on the lower, with 2 or 3 very small upper and 1 to 3 lower teeth in the center of jaw; the teeth are triangular, the first being erect but the remainder becoming increasingly oblique toward corners of mouth; the edges of the teeth are serrate from tip to base excepting the 1 or 2 near corner of mouth—none of our other Hammerhead Sharks have serrated teeth; free rear margin of second dorsal is about 3/4 as long as the front margin of the fin, and only about as long as its vertical height; pelvics with front margin more strongly convex and rear margins more deeply concave than in any other Atlantic members of this genus.

Color: Small specimens are brownish gray above and a paler shade of the same tint below with the dorsal fins, caudal and upper surfaces of the pectorals dusky toward the tips. Large ones are reputed to be dark olive above and pale olive below without conspicuous fin markings.

Size: Probably about 28 inches long when born. The largest of the hammerheads apparently mature at about 10 feet and commonly reach 13 to 14 feet with 15 feet reported.

Habits: Nothing is known of its habits to set it apart from its close relatives.

Range: Tropical and subtropical Atlantic but no details of its distribution are known. It is also believed to occur in the Pacific.

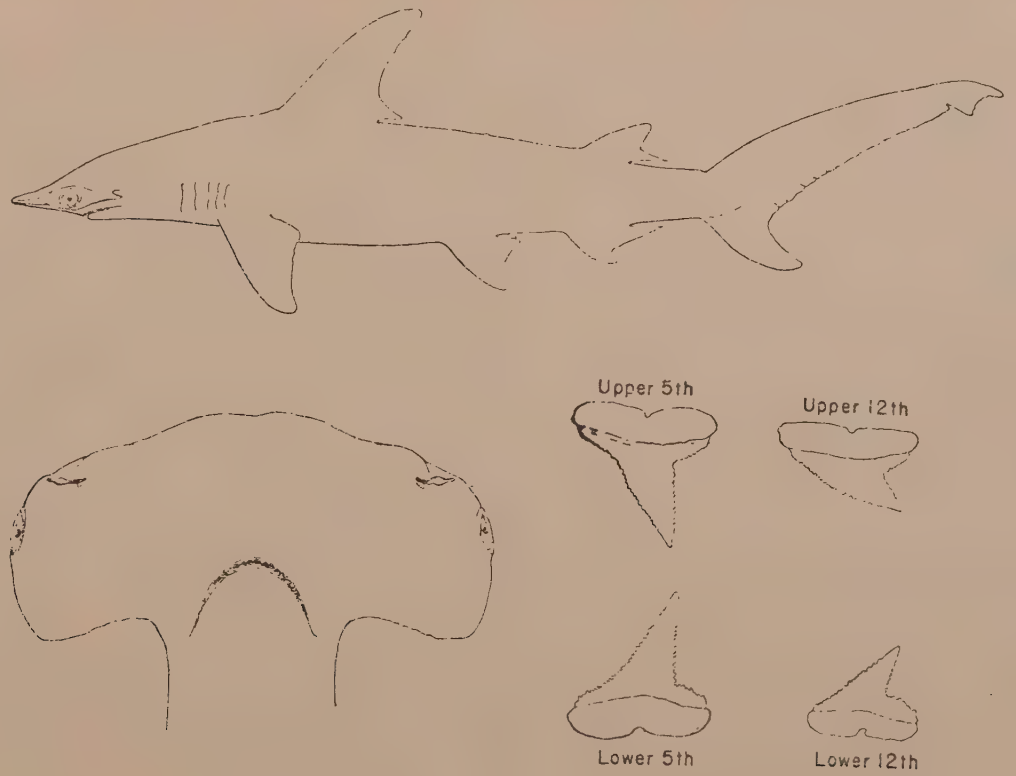


Fig. 51 Great hammerhead, Sphyrna tudes

Figure 52

Family Squalidae, Spiny Dog Fishes. Only five gill openings, the lower ends of all of them in front of the origin of the pectorals; two dorsal fins but no anal fin; with spiracles; the trunk cylindrical of the ordinary "shark" form; the front margins of the pectoral fins do not extend forward past the gill openings; each dorsal fin has a spine, long in some, but so short in others that it is apt to be overlooked.

Genus *Squalus,* Spiny Dog Fishes. The dorsal spines are at the points of origin of the fins and lie along the front margins of the latter; the teeth have only one cusp and the uppers and lowers are alike.

Figure 52. Squalus acanthias, Common Spiny Dog Fish.

Description: This Dog Fish closely resembles *Squalus cubensis* (Figure 53), but is easily distinguished from the latter by the facts that the inner corner of its pectoral is rounded and the inner margin only weakly concave, also that the point of origin of its first dorsal (or first dorsal spine) is over or behind the inner corner of the pectoral when the latter is laid back and that its sides are usually spotted with white.

Color: Slate colored above, sometimes tinged with brown; the sides irregularly marked with small white spots, (except in very large specimens on which they may be lacking); grayish or pure white below.

Size: Born at a length of 9 to 13 inches; males mature at 24 to 32 inches, females at 28 to 40 inches; adults (both sexes included) average from 2 feet to 3-1/2 feet long and 7 to 10 pounds in weight; a few grow to 4 feet, perhaps longer.

Habits: Chiefly in continental as contrasted with oceanic waters, anywhere between the surface and the bottom down to a depth of 90 to 100 fathoms; often in large schools and extremely abundant locally. In the northern part of their range they are regular migrants with the seasons northward and inshore in spring, southward and offshore in autumn. They feed on fish of all available kinds, not only those smaller than themselves but even larger. When abundant they are a great nuisance to fishermen for when they are taken out of water they use their spines for defense, and it is probable that these are slightly poisonous. The young are born chiefly from late autumn through the winter.

Range: Both sides of the north Atlantic, chiefly in temperate and subarctic latitudes; also both sides of the northern North Pacific; with close allies in corresponding latitudes in the southern hemisphere. This is by far the most plentiful of sharks along the coasts of the northeastern United States and of Canada. It is also certain that a few occur as far south as Cuba. It is probable, however, that published references to it there and around Trinidad were actually based on *Squalus cubensis.*

Fig. 52 Common spiny dog fish, Squalus acanthias

Figure 53

Family Squalidae, Spiny Dog Fishes.

Figure 53. **Squalus cubensis, Cuban Spiny Dog Fish.**

Description: Trunk slender; snout broad-oval; eye oval and noticeably large, its horizontal diameter about 1/2 as long as the snout (in front of the mouth); longest gill opening about 1/2 as long as the horizontal breadth of the eye; mouth traverse and only very slightly arched; teeth, 13 on each side in each jaw, the uppers and lowers alike, smooth-edged, with a single sharp cusp, the outer margins deeply notched and so oblique that the inner margins form a nearly continuous cutting edge from one corner of the mouth to the other. Point of origin of the first dorsal (or first dorsal spine) a little in front of the mid-point of the inner margin of the pectoral when the latter is laid back; second dorsal about 4/5 as long and as high as the first dorsal; the rear-lower edge of the upper lobe of the caudal is not notched near its tip; the lower lobe is between 1/2 and 2/3 as long as the upper; the distal margin of the pectoral is deeply and evenly concave and its inner corner angular (the shape of this fin is the most distinctive feature of this species).

Color: Dark gray above and paler gray below without white spots; the tips of the dorsals are black; the caudal, pelvics, and pectorals are edged with white.

Size: Matures at a length of about 20 inches.

Habits: Nothing is known of its habits except that it is a deep water species, caught at depths of 75 fathoms or more.

Range: General throughout the Caribbean, though so far known positively only from the north coast of Cuba, where it is caught commonly, and from Rio de Janeiro, Brazil.

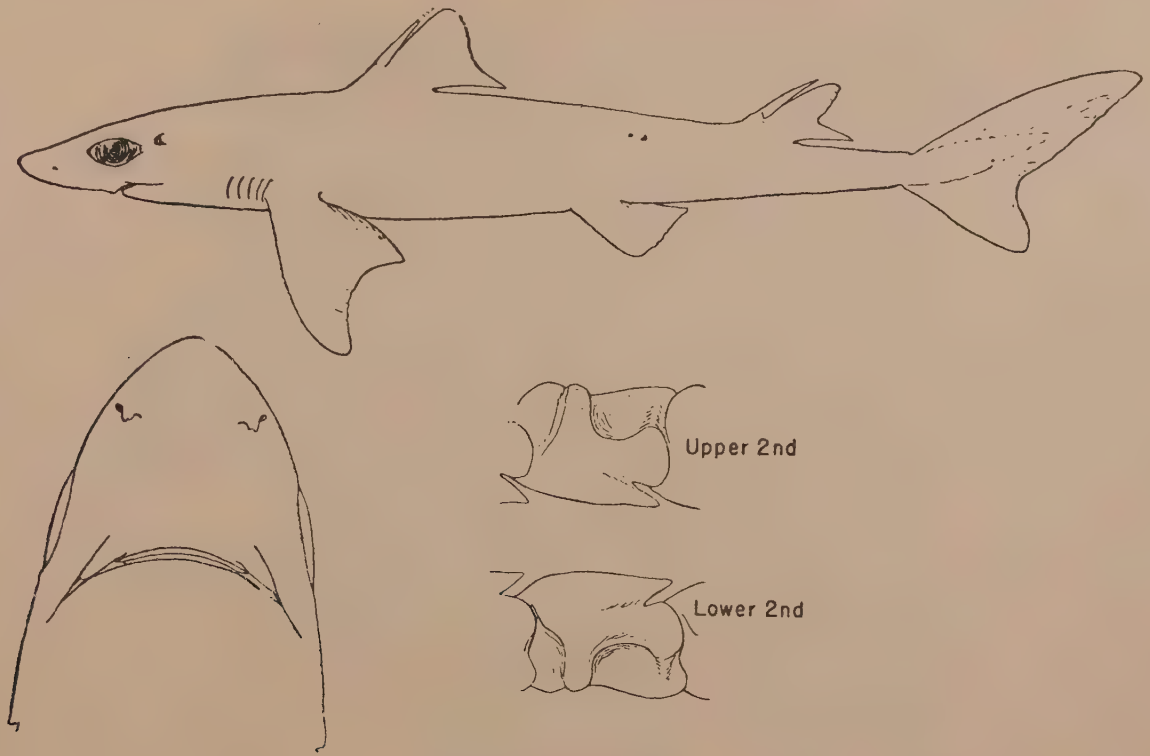


Fig. 53 Cuban spiny dog fish, Squalus cubensis

Figure 54

Family Squalidae, Spiny Dog Fishes.

Genus *Etmopterus,* Black Dog Fishes. The dorsal fin spines are at the points of origin of the fins and lie along the front margins of the latter; the upper teeth have several cusps and differ widely in shape from the lowers which have one cusp only.

Figure 54. Etmopterus hillianus, Black-Bellied Dog Fish.

Description: This little Dog Fish differs very obviously from the Common and Cuban Spiny Dog Fishes, in the facts that the lower edge of the upper lobe of its caudal is noticeably notched near its tip, that its lower caudal lobe is only weakly defined, that its second dorsal fin is considerably larger than its first dorsal, that its pectoral is brush-shaped, that its eye is relatively much larger, as well as that each of its upper teeth has from 3 to 7 sharp pointed cusps, and that its color is different.

Color: Dark gray or chocolate brown above (palest along the mid-line of the back); black below, with black dots scattered on the top of the head and along the back; and two to four lines of short narrow black dashes on the sides.

Size: Born at about 2 to 3 inches, it matures at about 9 to 12 inches in length. This is one of the smallest of sharks.

Habits: A deepwater species, living chiefly at 200 to 300 fathoms. Nothing else is known of its habits. It may be luminous, but whether or not this is the case is not definitely known.

Range: So far known positively only from Cuban waters where it is taken quite often on hook and line in deep water, from near St. Kitts, from the Tortugas, Florida, and probably also from Bermuda.

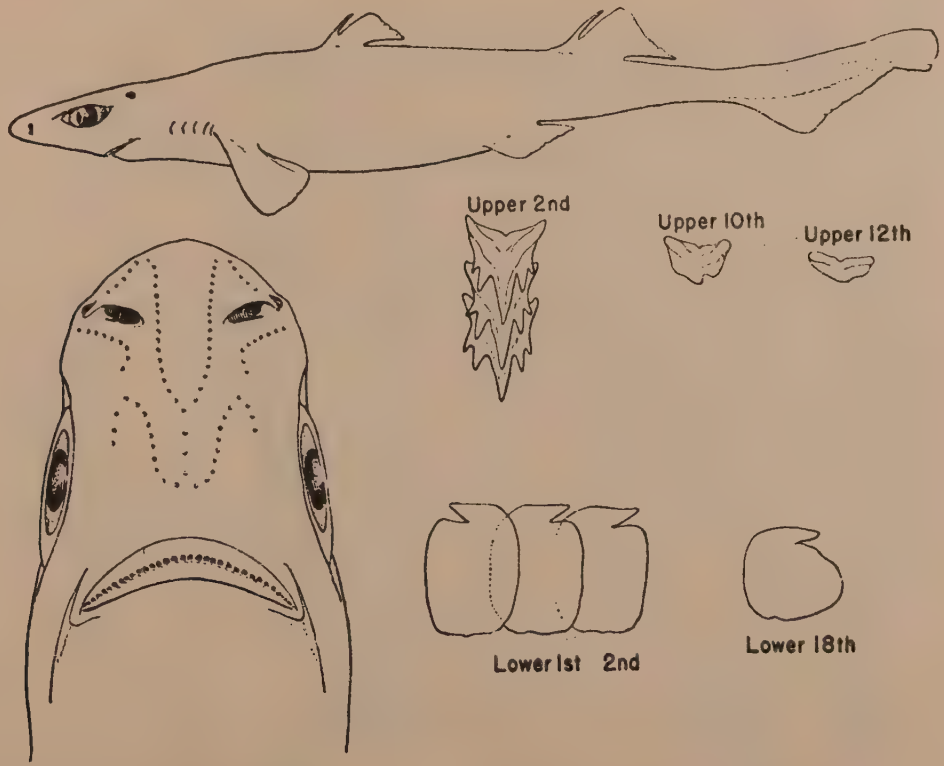


Fig. 54 Black-bellied dog fish, Etmopterus hillianus

Figure 55

Family Dalatiidae. Resembling the Squalidae, except that there are no dorsal fin spines.

Genus *Isistius*. The rear end of the base of the first dorsal is over the origin of the pelvics or behind them; the interspace between the first and second dorsal is shorter than that between the second dorsal and the caudal.

Figure 55. Isistius brasiliensis, Luminous Shark.

Description: Among the West Indian sharks of the ordinary body form that lack an anal fin, this species is set apart by the facts that it has no fin spines, its first dorsal stands so far back that the rear end of its base is about over the point of origin of its pelvics, its lower teeth are symmetrical and triangular, the uppers being thornlike and widely spaced, and its color pattern is unusually striking. (see below)

Color: Dark brown above and paler brown below with a conspicuous dark collar around the neck in the region of the gill openings. The lower surface (except for this collar) is thickly sprinkled with black dots.

Size: Females are mature at a length of 18 inches and recorded specimens have ranged in length up to 19½ inches.

Habits: This is an oceanic species; most of them so far taken have been caught at small depths or at the surface at night. Nothing is known of its diet or breeding habits. It is mentioned here because it is remarkable for being brilliantly phosphorescent, the entire lower surface (except the dark collar) emitting a vivid greenish light at times.

Range: Widely dispersed in the tropical and subtropical belts of all three oceans though it does not seem to be common anywhere. In the western Atlantic it has been taken off Rio de Janeiro, among the Bahamas and north of them.

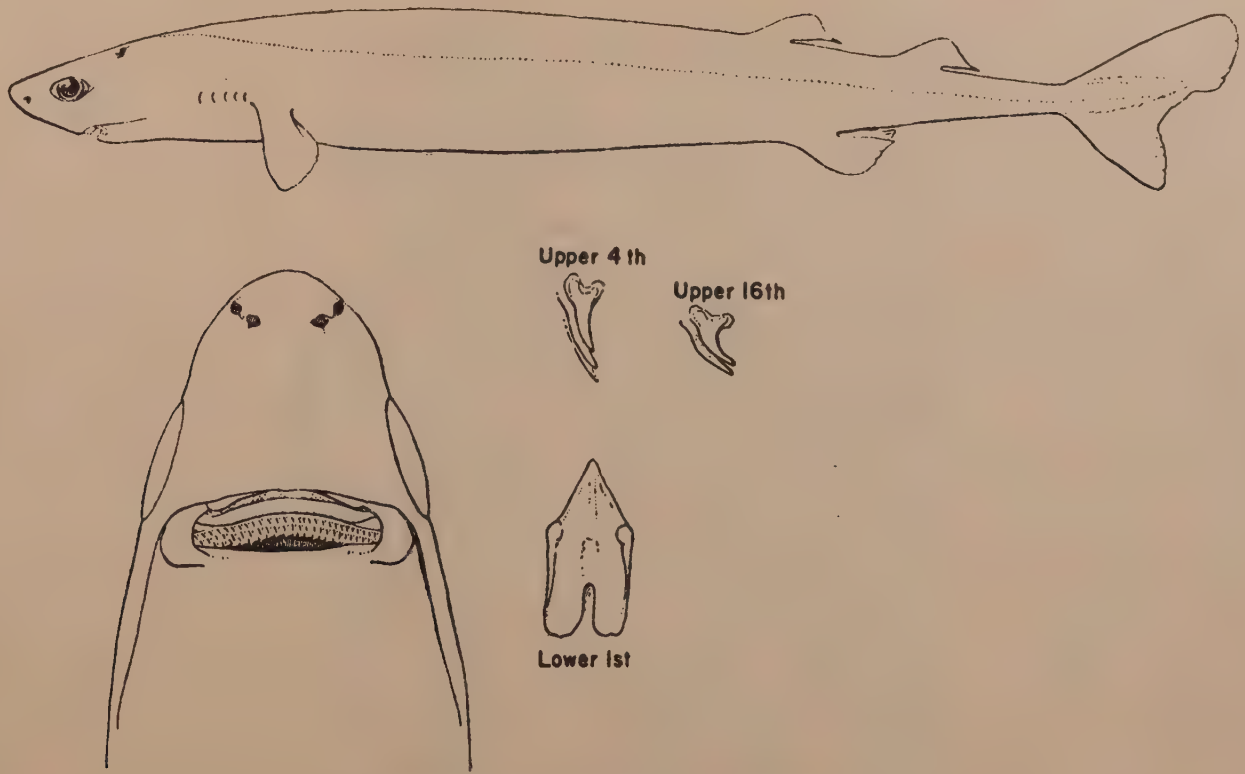


Fig. 55 Luminous shark, Isistius brasiliensis

Figure 56

Family Rhinidae, Angel Fish. Five gill openings, all in front of the origins of the pectorals; two dorsal fins without spines; no anal fin; the trunk very much flattened from above and below but expanded sidewise, with the front margins of the pectorals spreading so far forward that they extend beyond the region of the gill openings and largely conceal the latter; the mouth is at the front margin of the head and there is no definite snout; the eyes are on the upper surface of the head.

Genus *Rhina,* Angel Fish. Characters are as given above for the family. Two species of this genus are known to occur on the Atlantic coast of the Americas, the one (*R. dumeril*) from the east coast of the United States and reported also from Jamaica (Figure 56); the other *(R. argentina)* from northern Argentina, from Uruguay and from southern Brazil north as far as Rio de Janeiro, if not further. They are so unlike other sharks in appearance that there should be no difficulty in recognizing at least the genus to which it belongs if one should be taken. They are not plentiful enough in the West Indian-Caribbean region to be of any commercial importance, although they are more common farther south. They are most apt to be encountered in shoal water on the bottom where they often bury themselves partially in the sand or mud while lying in wait for the smaller fishes that are their chief diet.

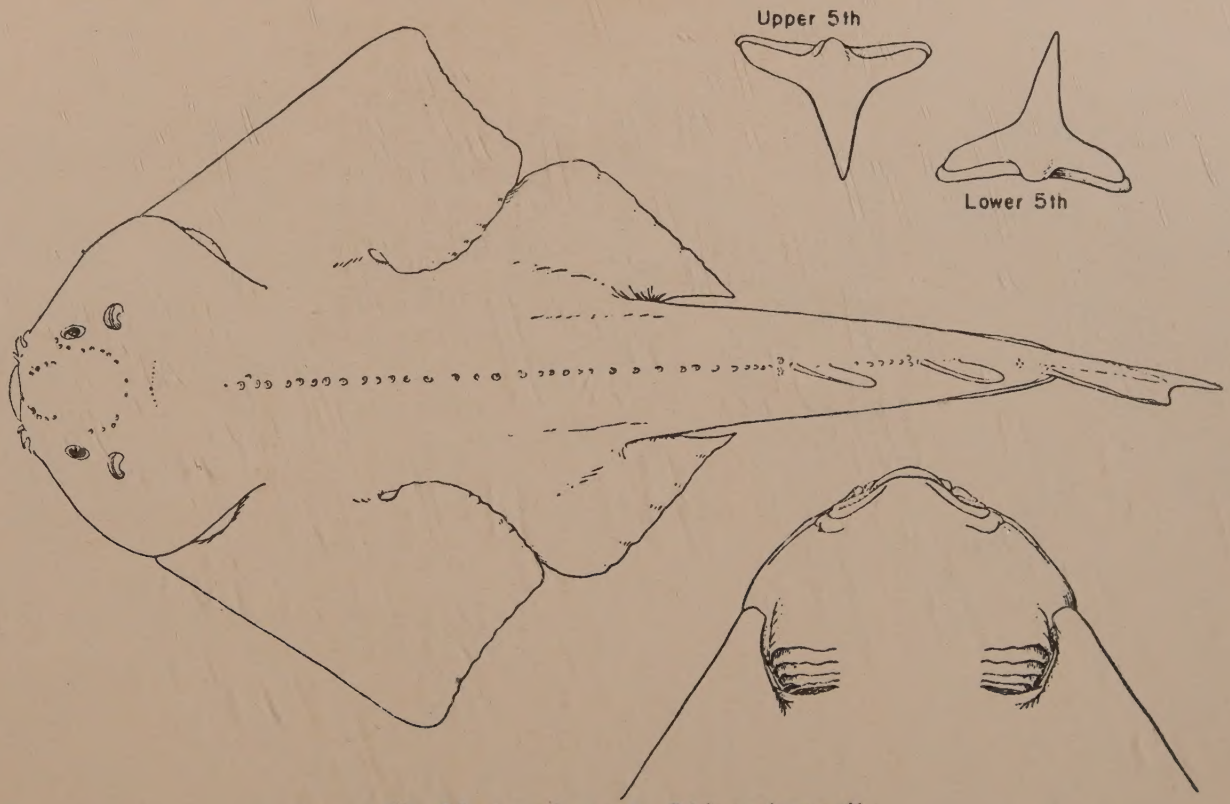


Fig. 56 Angel shark, Rhina dumeril